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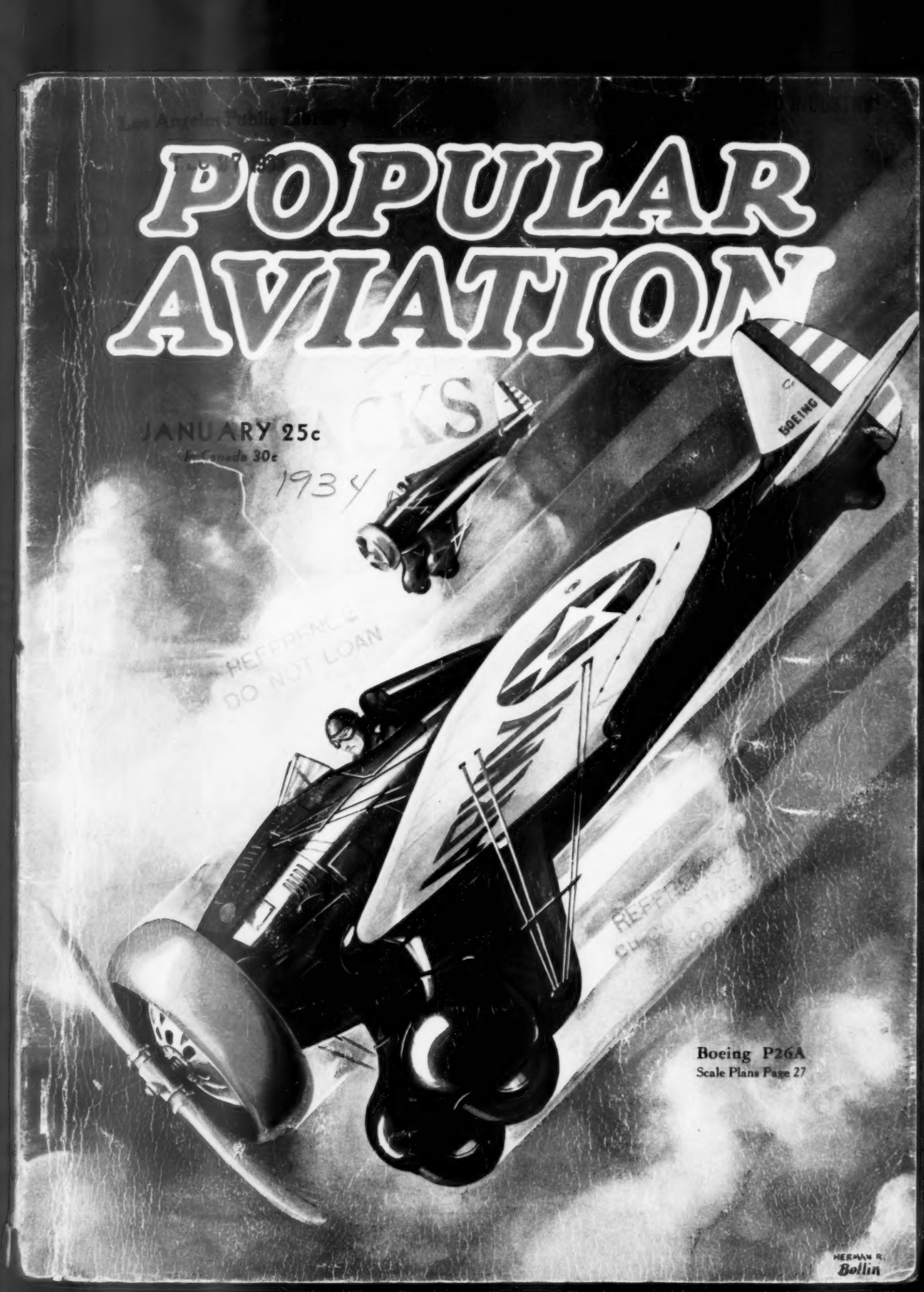

Boeing P26A
Scale Plans Page 27

HERMAN R. Bollin

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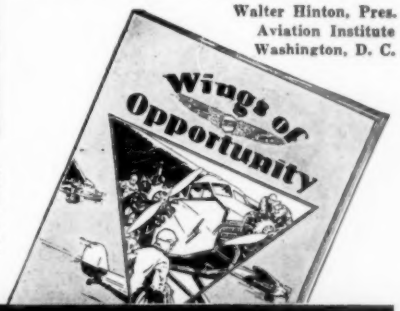

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The FEBRUARY Issue!!

POPULAR AVIATION covers all phases of aviation, written in an interesting manner that all can understand. It has long been the leader in its field and continues to grow and expand by the increasing support of its enthusiastic reader group.

Our February issue, besides containing all of the fixed features that has made P. A. so popular in the past, will present many new articles of great interest and value to all of our readers, whether they are amateurs, professionals or readers having only a casual interest in aviation.

This issue will carry the full page photograph that has been so popular, the new data sheets, dream ships, a larger model section, the industrial review, a lightplane section, the full page scale drawings, a technical article on wing calculations and another on a method of determining the center of gravity of a ship.

Then, there will be a rattling good war story, a humorous story of the barnstorming days, a description of an Army's recently developed blind landing system and a host of other articles of unusual excellence.

But, in order to make certain that you receive this number, and the issues that follow, it will be necessary to subscribe. A subscription will bring your copy earlier in the month, it will save you money and is a far more convenient method all-around. Our Junior Plan brings you five issues for $1.00. The regular subscription price is $2.50 per year. Send your subscription today.

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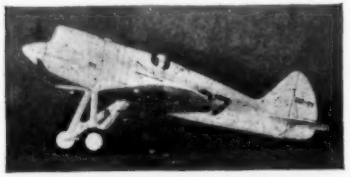

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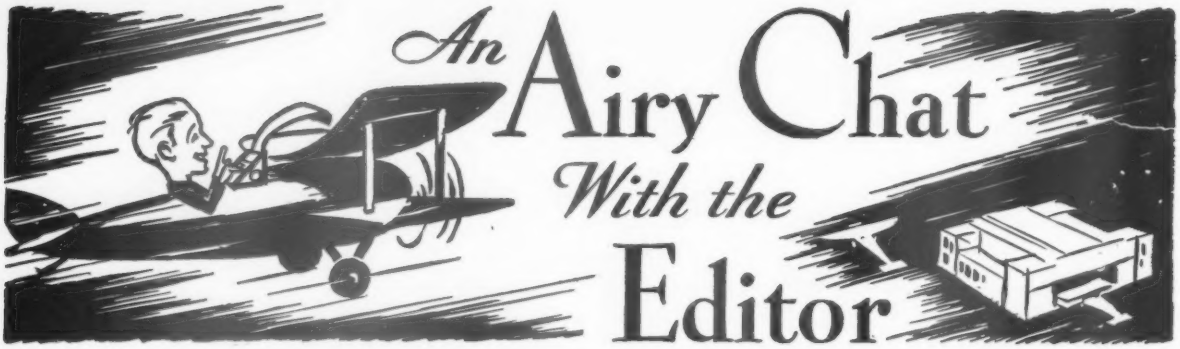

An Airy Chat With the Editor

WHEN I first started editing magazines, I raised my right hand and took a solemn oath. This oath ran to the effect that never, never would I start out in the January issue with the old threadbare line, "prospects for the coming year were never more promising," and up to now I have kept my word.

But I am now going to break that oath, even though it is New Year's day, because the prospects most certainly look brighter than they have for some time in the aviation industry. Whether it is due to the NRA, or not, manufacturers are pushing development work to the limit and this is certainly some change for the better.

It has been a long time since so many announcements of new types of planes, new engines and new accessories have been received at this office. We proclaim the fact that there is a most astonishing renewal of interest in new productions—both military and civilian.

* * *

OUR cynical readers will scoff at the above lines with the remark that this is the "regular standard New Year's hooey," but such is not the case. It is a real and undeniable fact that things are improving in aviation and POPULAR AVIATION is sharing in this revival of prosperity!

* * *

DID you work out that cross-word puzzle in the last issue? Well, just take a look at the answer in the Question and Answer Department and check-up on yourself. We think that the puzzle in the next issue will be easier than the first one, so if you didn't get the first job right, take heart and tackle the next offering. There are no prizes attached to the solution of these puzzles—a true cross-worder needs no inducement.

* * *

WELL, we see that an amateur airplane builder has finally been sent to the jail-house, in the State of Washington, for daring to fly his home-built ship. He couldn't pay the fine, so he is now on the inside looking out.

This thing burns us up. It's too bad that he did not have enough money to contest the case and thus test the constitutionality of those fool state regulations. We are waiting in the hope that some amateur will come along who is sufficiently well financed to offer himself up as the sacrificial lamb in a test case. This would be one way of knocking the anti-aircraft barrage for a row of ash cans.

* * *

ALL hail to Major "Shorty" Schroeder who has recently been made head of the Air Line Inspection Division of the Department of Commerce. This is a big job and an important one, but Major Schroeder will fit the job like a shoe. We only hope that others, as competent as himself, will be appointed as chiefs in other divisions.

Announcement

THE February issue will contain an item of great interest to our readers, particularly to our airplane picture fans.

This will be a beautiful insert, printed on highly enameled paper similar to the inserted view of the Boeing "247" in the July issue. The subject of the coming insert will be a flight picture of the new super-transport Donglas DC-1.

Accompanying this insert will be a fully detailed description of the Douglas DC-1, together with a phantom view showing the interior arrangements. We know that this will be good news to the great majority of our readers.

YOU may think that I am stretching matters when I tell you that no less than 37 inventors have brought their brain children for inspection to our office. A Full 37—count 'em—and all in one month.

This covers all sorts of ideas on all sorts of subjects, and several of them are very ingenious and praiseworthy.

* * *

AS YOU probably remember, the majority of POPULAR AVIATION front covers, of previous issues, have carried a printed list of the leading articles, in large black type. This printed matter was omitted on the cover of the December issue and now on the cover of this issue. Do you approve of this change or not? Please tell us.

AND while you are writing to us on this subject, add a few more lines and tell us what you think of the data sheet idea. It is rather too soon to expect clear expressions on this subject, we appreciate that fact, but still we're anxious to know how this idea is going over. Do you like the dictionary idea? We'll have words in future sheets that 90 per cent of our audience never heard of before.

* * *

OUR government has trained the finest type of young men in the science of aviation and has provided the finest military planes for this purpose. Millions of dollars have been spent, and each pilot represents many hundreds of flying hours.

But now, many of these highly-trained and intelligent young men are being transferred to officer various "CCC" camps where they will rapidly lose the technique of flying that was so painfully acquired. This is at once a great loss of time and money and, at the same time, a grave hazard to our national defence. It seems to us that officers for the "CCC" details could be taken from less specialized branches of the service, thus permitting us to maintain the high efficiency of our air force.

* * *

THE opening exercises, or rather the revival of the Photo Phans Club, has brought back many familiar signatures in our pile of letters. They are still ardent picture enthusiasts and welcome the reorganization of this department even after a lapse of a year.

* * *

HOW are you coming along with that model of the Boeing "247" that you intend entering into the contest? Even though the time limit has been extended to December 26, you will not have very much time left after you receive this issue. Better step on it—and do a good job for the contest will call for your best efforts.

* * *

GLENN D. ANGLE, in his aviation engine article, made a pertinent remark. It is his hope, according to his article, that returning prosperity will not again bring forth a deluge of half developed engines by makers who are more interested in quick sales than in quality or performance.

(*Concluded on page* 57)

POPULAR AVIATION

Including SOUTHERN AVIATION and AERONAUTICS

A MAGAZINE FOR THE PROMOTION OF AMATEUR AVIATION AND PRIVATE FLYING

Volume XIV JANUARY, 1934 Number 1

NRA MEMBER U.S. WE DO OUR PART

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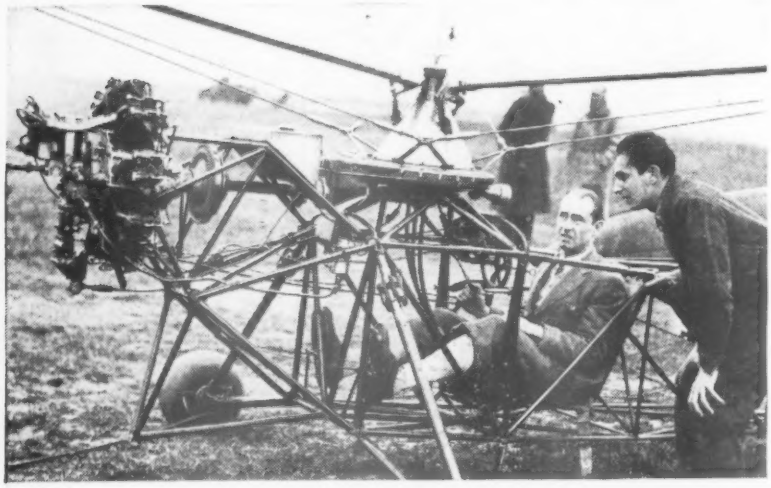
Will the Helicopter Become T



The Hagler-Hafner helicopter, a recent development that is said to be a distinct advance over any helical lift device yet tried.

by

ALVIN EDWARD MOORE

Patent Examiner, U. S. Patent Office and expert on aeronautical inventions.

LIKE THE fish that lies at the bottom of the sea and peers up into the watery depths that limit its environment, earthbound man lives at the bottom of an ocean of air and looks up longingly at the blue limits of his existence. But unlike the fish, man has the conscious mind and the will necessary to attempt to explore his upper depths.

In the days of his youth, hundreds of thousands of years ago, man dreamed beautiful dreams of feats that were impossible—of rising on magic carpets and the wings of an angel, of riding winged horses and in cars drawn by tamed eagles. But in the age of his maturity, facing hard facts with a scientific eye, he has been busy for centuries inventing and designing helicopters and hoping against hope that each will be the solution of his age-old problem. Helicopters, be it understood, are direct lift machines pulled up into the air by "helices" or propellers, without wings.

None so far has succeeded. Some of the hundreds have risen, but none has been capable of sustained vertical flight. The world's endurance record for the helicopter of eight minutes, forty-five and one-half seconds, made some two years ago has recently been beaten by a flight of 9 minutes. Because of the small measure of this success, most practical aeronautical engineers have dismissed the problem of vertical flight by helicopter as one that can not be solved for a long long time to come.

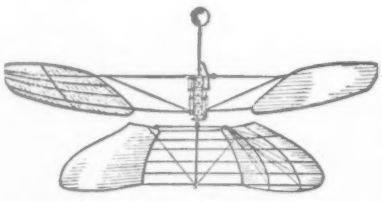
But the human race has not given it up. Patents for new types of helicopters are still being granted year after year by the patent offices of the world. Several inventors, moreover, at this moment are on the right road to a solution of this major problem of aeronautics. Present trends in helicopter design indicate that within the next few years there will be born a safe and efficient vertically rising aircraft—a machine that will change man's customs even more than did the automobile.

In the mass of patents and articles concerning the helicopter we find two basic types of machines.

First, there are those in which the fuselage or carriage is suspended from vertically lifting propellers or airscrews that rotate in two or more axes of rotation. An example of a machine of this type is that built by Dr. George de Bothezat, Dayton, Ohio, under the auspices of the United States Army Air Service.

This machine, for which he filed application for a patent in 1923, had four airscrews attached to the extremities of four arms of the framework of the carriage. The operator could control the amount of lift of each propeller by complex means which varied the angle of incidence of the propeller blades. Thus, if the craft started to tilt to the right, he lessened the lifting force of the left propellers, and vice versa.

This complicated helicopter was sixty-five feet long each way and weighed 3,400 pounds when empty.



Professor Forlanini's miniature steam powered helicopter of 1877, was the first helicopter to rise.

Two-thirds of this weight rotated. In its tests it rose from the ground but did not prove to be practical. Let us call this first class of machine, to which it belongs, the multiple—sustention type of helicopter.

The second type of helicopter is that in which the carriage is sustained by one or two airscrews rotating in only one axis of rotation. The familiar Autogiro has a carriage or fuselage thus sustained by one airscrew or rotor, but as its rotor is rotated by the wind of forward motion due to the ordinary airplane propeller in front, it therefore does not rise vertically, it can not be called a helicopter.

The first helicopter designed on paper and the first powered by an engine were of this second type. The god-like Italian, Leonardo da Vinci, drew the first, and another Italian, Enrico Forlanini, powered the second. In 1877 Forlanini set the ball of invention rolling by mounting his miniature steam engine in a small helicopter model, turning on the power and watching the little craft lift itself. This model was sustained by two airscrews, one rotating clockwise and the other anti-clockwise, about a vertical axis of rotation. It, therefore, is classified as a helicopter of this second, or single-point sustention, type.

In addition to the complicated machine of Dr. George de Bothezat, a number of differently designed helicopters of the multiple-sustention type have risen from the ground.

In 1905, the Dufaux Brothers of Geneva, inventors of a gasoline motor attachment for the bicycle, turned their inventive talents to the problem and built a model of a machine with two biplanes at each end—for horizontal flying—and in the middle, a pair of vertical airscrews connected to a small gasoline engine for lifting. They attached it to two endless cables, resembling those of an elevator, that they had rigged up in their experimental shed, and tried it. They were delighted when it rose with little difficulty and was stopped only by the roof.

Every industrial art has hundreds of such inventive pioneers, who give their time and efforts and often lives in the unpaid struggle to establish the first

ne The Future Flying Machine?

NEARLY every aeronautic inventor has considered the feasibility of the helicopter principle, but to date, no practical direct lift machine of this type has been constructed. Even the Wright Brothers devised a combination helicopter and airplane, while the famous French engineer, Louis Breguet, spent much time on this project.

The author, well informed on helicopter developments, discusses the various types of helicopters noted in history and, in a future article will enter further into the problem that has defied engineers for 100 years.

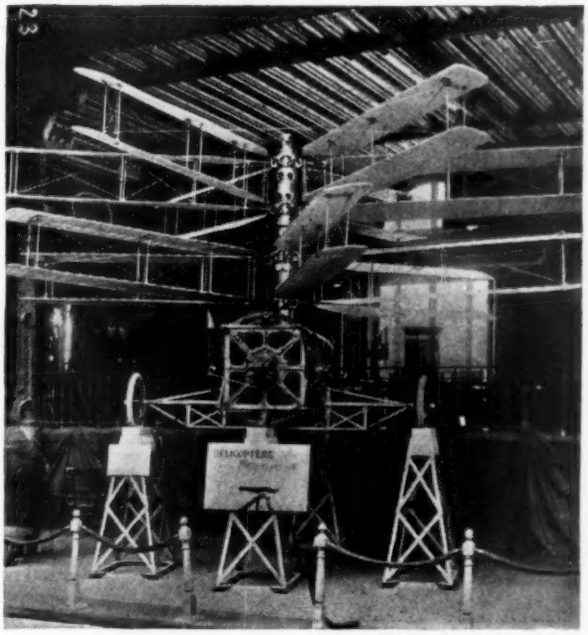
steps to the solution of some problem of the human race. Most of them finally give up their struggles and settle down to the humdrum business of the world, just a trifle saddened, just a bit life-weary. But always there are a few who, in the face of continued disappointment and ridicule, still persevere and press onward into the frontiers of science, with all the ardor of an explorer of new lands or worlds.

Of these few, there is often one who is a genius, who hits on a basic solution long before the world is ready for it. He usually goes to his grave unsung while some other inventor—or group of inventors—perhaps no better than a clever engineer, develops his basic idea, makes it work, popularizes it and receives the adulation of the world.

Such an unsung pioneer is Louis Breguet, Paris, France, in my opinion the most significant of the helicopter inventors. He is still living and inventing, and before he dies, I hope he receives some measure of the credit which seldom comes to his kind.

In 1907 the aeronautical world first heard of Breguet. He had done a great deal of experimenting with the helicopter and at last designed a machine which he hoped would solve the age-old problem of vertical flight. It had four two-bladed helicopter propellers rotated through shafts and gears by an engine.

This much of the craft involved nothing unusual. But here we come to the basic invention, embodied in two features of construction that have been built into the successful Autogiro, into the three most successful helicopters to date and that probably will be built in millions of common helicopters in the not distant future. These features seem simple, as indeed does every great invention or discovery when we look back upon it.



—*U. S. Air Service Photo*

The Pescara helicopter, driven by a 60 h.p. auto engine, which employs variable pitch biplane blades. The two rotors revolve in opposite directions so as to neutralize the torque.

Breguet's vertically lifting propeller vanes were large, resembling an airplane wing more than the blade of an ordinary airscrew, and each vane was flexibly mounted by means of spring bands to its shaft. The large vanes exerted a great lifting force and their flexible mounting caused them (automatically) to change their angle of incidence as they encountered changing air pressure during rotation.

Before this invention, every helicoptive propeller had rigid blades which tended to unbalance the craft during forward flight. This was due to the fact that the rigid blade, which was moving against the pressure of the airstream of flight, would exert more lifting force than the other blade which was moving with the airstream.

Breguet, by the seemingly simple expedient of flexibly mounting the blades, made them automatically adjustable to the different air pressures encountered during rotation. Thus, he solved one of the basic problems of the helicopter.

His machine, patented in France, March 11, 1907, rose on August 24, 1907. According to the brief record of the event, it did not have a pilot on board. Its main fault was its instability due to the position of the helicoptive propellers.

The following year, Breguet made application for a second French patent on the invention and it was granted to him in 1909. It discloses several ways of flexibly mounting the propeller blades on their shafts. One was by utilizing leaf springs, another by providing a universal mounting for the horizontal shaft of two rigidly connected blades, and the third was by hinging each blade to its shaft, in the same manner that Autogiro blades today are hinged to their shaft or mast.

Thus, some fifteen years before Juan de la Cierva flew his first Autogiro, this pioneer created one of the basic features which permitted that machine to fly. Juan de la Cierva, it is true, was the first inventor to utilize the wind to rotate helicoptive propellers or wings, but Louis Breguet long before had laid the groundwork, not only for the Autogiro but for the successful

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—*Courtesy of Smithsonian Institution*

An American Helicopter, invented by Emil Berliner, which actually left the ground for a few feet.

A Graphic Illustration of Radio Communication

The pilot of a commercial transport is speaking to the land station through his transmitter.

RADIO communication between commercial transports and the ground stations, marks one of the greatest developments in commercial airline operation.

Above, we see the pilot with the "mike" or microphone to his mouth, talking with the ground station reporting his location, altitude, speed and the weather conditions about him. A short-wave radio transmitter in his ship radiates the radio waves just like the broadcast stations. He also employs a radio receiver, connected with the head-set shown, by which he can receive messages from the ground stations and other planes. This is called, therefore, a "two-way communication system."

Below, is a scene in the office of the plane dispatcher, who is comparable to the train dispatcher on a railroad system.

Here, the radio dispatcher at the land station is listening-in to the pilot's message. Note the sequence clocks in the background.

Here Are Two New Fuel Experiments

TWO widely-separated tests, in which oil was used as fuel for airplane motors instead of gasoline, have opened a new line of thought for aviation designers and builders.

Perhaps the most interesting experiment was that conducted at Newark, N. J., Metropolitan airport, where a device invented by Alfred Schwarz, metallurgist and petroleum expert, was placed on a high-compression gasoline engine and the engine made to perform efficiently on ordinary furnace oil.

In the other test, conducted at the Oakland, Calif., airport, a lightweight steam engine that uses fuel oil of the type used in Diesel engines was placed in a standard biplane and the plane flown numerous times.

In the Newark demonstration, the device was applied to a four-cylinder Gypsy engine in a Moth biplane. The pilot, C. J. Strickland, first started his motor with gasoline and then, just before taking off, he removed the gasoline tank and switched to fuel oil. After a few preliminary coughs and a little smoke, the motor picked up again and ran as smoothly as ever. Strickland took off, made a 10-minute flight and landed.

The device consists of a small metal tube or chamber screwed into the cylinder-head between the spark-plug and the cylinder. This brings about a double ignition, doing away with knocks and, according to its inventor, making it possible to obtain perfect results with fuel oil, or much higher efficiency with low grade gasolines.

What takes place is this:

The spark sets fire to the fuel, which the compression stroke of the piston drives up into the little chamber. This little conflagration spreads down into the compressed fuel just as the piston reaches dead center and ignites the oil evenly and completely throughout the chamber, thus delivering the most powerful force of which it is capable.

Dr. Miller Reese Hutchison, an inventor formerly associated with Thomas A. Edison, witnessed the test and revealed plans to take part in further exhaustive tests of the device.

The steam engine used in the Oakland test is the invention of William J. Besler, pilot and experimenter, and his brother, George, both of whom are sons of W. G. Besler, chairman of the board of the New Jersey Central railroad. This engine and the ship have already been described in POPULAR AVIATION.

The engine is a two-cylinder, compound, double-acting V-type with a bore of three inches and stroke of 5¼ inches. It has an inlet pressure of 1,200 pounds and delivers about 150 horsepower at 1,625 revolutions per minute. Its weight is 180 pounds, which the brothers believe easily may be further reduced.

Eight Yanks Won the Same Cross

by CARL B. OGILVIE

Here we have the amazing story of the eight men who were each awarded the Distinguished Service Cross in the same action — one terrific dog-fight against overwhelming numbers of German planes.

ONE OF the most singular incidents regarding the award of the Distinguished Service Cross to World War heroes was that one for which no less than eight American officers received the Cross with one of the most remarkable citations ever recorded in our War Department annals.

It is all the more strange and interesting that the citation and crosses were bestowed for one single terrific and gallantly fought dog-fight against overwhelming numbers of German planes. The most amazing feature of the whole affair, which I happened to stumble blindly upon, is that not all the recipients of the D. S. C. were aviation officers. Infantry and Field Artillery lieutenants are listed in this illustrious group together with Air Service pilots and observers.

Go ahead and wrinkle up your learned brows. Question the veracity of my statement. But remember, I have official data to back up my claims and I know whereof I speak.

Now, it's a known fact that our country wasn't over generous when it came to recognizing gallantry in the air. Especially, when she is compared to France who was a spendthrift in tossing out Croix de Guerre and Medals of the Legion of Honor. But remember that France's Air Force had reached the utmost limits of its endurance and her man-power was extremely low. Deep appreciation and a deep sense of gratitude for what the American airmen accomplished could only be shown by awarding medals. France is like that—emotional. But America was extremely reserved in recognizing gallantry in action. Flying and fighting was the Air Service's duty. As one War Bird put it—

"The United States Army H. Q. is so stingy with its trinkets a bird has to get himself killed and haunt the Adjutant General before he is awarded a medal." And for that reason, the awarding of eight medals for a single citation is all the more startling and interesting.

An American pilot had to do something high and above just ordinary patrol flights and fighting to save his own life. He had to prove by his devotion to duty, that he possessed high courage. A willingness to face danger with a total disregard of himself. Prove he was a capable and effective fighter in the air. And even some of the lads who proved their worth were never recognized as the heroes they unquestionably were.

FOR citations, medals and oak leaf clusters it was the pursuit pilots that got the break. The pilots of observation planes rate a weak second, and an observer—well, according to the opinion of the uninformed, he just flew to the theatre of activities in a box-seat and looked on. So there were frugal numbers of D. S. C.'s handed out to these gallant lads with single wings pinned to the left breast of their tunics. There are a few instances where two men won medals for the same citation. For instance the citation awarding Harold Earnst Goettler and Irwin E. Bleckley was identical.

A rare photograph from the World War showing a British plane taking off for an engagement with the enemy above him. Note the indifference and casual interest exhibited by his comrades standing at *Alerte*.

Because the award included officers from three separate and distinct arms of the service I can hear you asking: "How can Infantry and Field Artillery officers be cited and awarded medals for an aerial battle that took place 3,000 to 5,000 meters above the River Aisne?"

And right on top of that question I figure your curiosity gets the better of you and you ask: "Who were they?"

The next logical question is: "How did they all happen to get up in the air over the Huns? That's not so hard to explain. Lieutenants Babcock, Bernheimer, Hitchcock and McClendon were pilots of observation planes. Burns, Jordan, Palmer and Plummer, from 165th Infantry, 7th, 15th and 101st Field Artillery, respectively, were the observers. They were attached to the squadron to act in the capacity of observers. There we have an Infantry officer and 3 Artillery officers serving with the Air Service, in the same squadron. Almost half of those brave and gallant young officers lost their lives in the service of their country. Burns, Hitchcock, McClendon and Plummer were awarded the Cross posthumously.

Young men, eager for adventure; patriotism throbbing in their veins; from the East and West, brought together in France as if for this one outstanding deed of extraordinary heroism in the face of the enemy. And, in exactly one week less than a year after 88 was organized at Kelly Field, Texas, they put on the battle of the century—won for themselves a place on the Honor Roll of Heroes.

IN THE Zone of Advance, Squadron 88 was assigned to the duties of Corps Observation. It was not a fighting organization—that is, it was not supposed to fight. Yet these men fought one of the most brilliant one-sided battles ever staged in the sky-lanes. Fought bitterly to a victorious conclusion.

The pilots of 88 had seen no previous battle front experience. And the observers had none, or but little, actual war duty with the French. The mission of a Corps Observation squadron was primarily to keep the command informed by visual and photographic reconnaissance of the general situation

within and behind the enemy lines. To accomplish this, a routine schedule of operations was prescribed for each day. It consisted of several close-range reconnaissance of the sector, and toward dusk a reconnaissance for hostile batteries in action.

In addition to this routine work, special missions were arranged, in many instances for the day following. Artillery adjustments in particular were carried out, and many long distance and special reconnaissance. Except in one case of the attack on Seicheprey, no opportunities were offered the personnel of 88 for contact patrols.

The 88th Aero Squadron was attached to the 1st Corps Observation Group at the Marne sector early in July. They occupied an airdrome about 55 kilometers from the German front lines, west of Chateau Thierry to Courchamps. The enemy were amassing a tremendous amount of men and supplies for its last desperate and final drive to gain ground south of Paris. A hopeless drive to break the Allied lines—to crush them.

A powerful German Air Force had been assembled. Everything was done by the Germans to prevent the Observation squadron from learning the position of their artillery and numerous strong points in the Belleau Woods and around Chateau Thierry. Photographic planes particularly were attacked by squadrons numbering from seven to twenty swift Fokkers. Observation pilots and observers became honorary members of the Air Service's "Suicide Squadrons."

Squadron 88 was "on alerte" from dawn to dusk. They carried out reconnaissance and photographic missions far behind the enemy lines. The Huns made every effort to shoot them down. But the Americans kept flying and fighting. They succeeded in their missions. Sent timely and important information to the Corps Staff against tremendous odds.

When the American doughboys smashed through the Germans' line, broke up the drive, sounded the doom of Imperialism, the work of the Observations squadrons changed materially. Trench warfare was over. The war became one of movement. Fighting in the open along lines that General Pershing had always insisted his troops be trained. Immediately the difficulties of keeping ground and air forces in close touch increased. Contact patrols became of greater importance. Regulation of artillery fire on enemy batteries became more difficult.

Instruction courses were inaugarated. Infantry officers were given short intensive courses in aerial liaison. Artillery officers began flying to ferret out the moving targets of German batteries. Pilots were even sent into the front line trenches to give them a broader understanding of contact work with moving troops. This explains how it came about that Infantry and Artillery officers shared in the glory of an aerial dog-fight. Their duty was that of observers getting information for their respective arms of the service under command of the Corps.

An old wartime "D.H." or DeHavilland, a ship frequently used for photographic missions, such as described here, and as a light bomber.

Squadron 88 had just reached the Franchiville airdrome a week before the big push. They didn't have proper time to prepare for extended action. But when the Allies got their war machine in operation in a big counter operation from Chateau Thierry to Soissons, the men of the squadron got every plane at their disposal into the air. Winged aloft against a superior and more experienced air force.

AMERICAN soldiers had recaptured Chateau Thierry. Epemy was evacuated by the Huns. The Yanks were pushing the now bewildered armies of Bulow, Kluck and Hausen back to the River Vesle from Soissons to Rheims. The Corps command was in need of important information. The exact location of German troops and supply centers had to be definitely discovered. The railways from Etavigny to Rheims was of strategic and tactical importance. The Germans were in retreat and they must be kept moving. It was necessary to locate their batteries and silence them.

So, on August 11th, the order came to Squadron 88 to get *one plane* over and get back *safely at all costs*. Orders were to make visual observation, but more particularly to bring back photographic records of real tactical value. The Corps was in desperate need of photographs of important positions. Pin-point photos, the most dangerous form of photographic mission, had to be made. Low altitude, over designated positions, within range of anti-aircraft guns. At the mercy of diving planes. Those are the hazards of pin-point work.

But the men of 88 never faltered.

First Lieutenant Bernheimer was selected as the pilot of the reconnaissance photographing plane and Second Lieutenant Jordan, a Field Artillery officer, was detailed his observer and photographer. And so, at the very outset, we have the coordination of men from two branches of the military service setting forth with a single objective. They took off with the protection of three two-seater pursuit planes with the other six men mentioned in the list. Their duty was to see that the single photographing plane got back—at all cost!

That special mission patrol of four planes winged its way over the Marne, the River Vesle and continued far back into the Hun territory to the River Aisne.

Ten miles back in Hunland, Bernheimer kept his ship to its course, flew directly to the points to be photographed by Jordan. He depended implicitly upon the flying skill of McClendon, Hitchcock and Babcock to keep threatening Fokkers and Albatrosses away. It was up to those men to protect the photographing ship. The marksmanship of Plummer, Palmer and Burns had to ward off all comers, see them home safely. Sacrifice men and planes that Corps H. Q. should get its photographs.

Then, just as their extremely dangerous mission was completed, twelve enemy planes came with the speed of meteors diving down upon the Americans.

The horde pounced upon the one ship they knew had damaging negatives of

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The Eight Officers Receiving the Citation

Name	Grade	Organization	Born	Residence at Enlistment
Babcock, Philip A.	1st Lieut.	88th Squadron	Lyme, Conn.	Lynn, Mass.
Bernheimer, Louis G.	1st Lieut.	88th Squadron	New York, N. Y.	New York, N. Y.
Burns, James S. D.	2nd Lieut.	165th Infantry	New York, N. Y.	New York, N. Y.
Hitchcock, Roger W.	2nd Lieut.	88th Squadron	Nutley, N. J.	Los Angeles, Calif.
Jordan, John W.	2nd Lieut.	7th Field Art.	Indianapolis, Ind.	Indianapolis, Ind.
McClendon, Joel H.	1st Lieut.	88th Squadron	Ferris, Texas	Farmers Branch, Texas
Palmer, Joseph A.	2nd Lieut.	15th Field Art.	Zanesville, Ohio	Zanesville, Ohio
Plummer, Charles W.	2nd Lieut.	101st Field Art.	New Bedford, Mass.	South Dartmouth, Mass.

Aloft in a Navy Balloon

by ROMAN J. MILLER
Lieut. Commander, U. S. Navy (Retired)

A balloon makes no noise and it makes little speed, but a balloon trip can be replete with thrills if the weather becomes unruly. Read the author's tale of a hair raising voyage in a Navy balloon.

NIGHT flying in a free balloon is likely to include a thrill or two. In fact, it may even lead to a gamble with death, which is bound to be fascinating.

Perhaps it is the uncertainty of outcome,—the encountering of the unexpected which is most appealing. Then, also, there is the lure of soaring along through the silent hours of the night with entrancing views of Mother Earth in evening dress below.

It was a clear cold night in December, when the writer, in company with three other Naval Officers, took off in a free balloon from Lakehurst, New Jersey, and proceeded on an all-night flight. We wore the regulation Navy fur-lined flying clothes; we also carried in the basket of the balloon, emergency rations, maps, navigating instruments, four carrier pigeons and 780 pounds of sand ballast. The sand ballast was put up in canvas bags weighing 30 pounds each.

As the ground crew released the balloon, we ascended gently aloft into a moderate east wind that would carry us inland over the States of New Jersey, Pennsylvania and probably into Ohio. The full moon cast a radiance upon the scene, and the great spherical balloon shimmered in the suffused light like a gigantic silver ball. Soon we were drifting slowly over the pine forests adjoining the airship base at Lakehurst, and headed on a course that would carry us over the town of New Egypt, New Jersey.

The lights on the immense airship hangar twinkled in farewell, while the light on the top of the mooring mast gave us a good point of bearing while navigating across the somber forests. To the eastward lay the coast with its white line of surf, and the piercing light of Barnegat gleamed out over the waters of the Atlantic. An occasional yelp of a fox in pursuit of prey,—the hoot of an owl and the startled flight of a deer came to us from the forest below.

After an hour's leisurely cruise, the forest was left behind, and we gained the farming district adjoining. The shadow of the balloon on the ground gave us an accurate check on our speed. It likewise attracted the attention of stray dogs of the country side and they barked furiously at the silvery phantom, sailing mysteriously overhead.

We were sailing along at an altitude of only 500 feet and the balloon also attracted the attention of pedestrians along the country roads and villages, as we glided along through the night. As we passed over New Egypt, we shouted down through a megaphone to a group of spectators in the street below, and their replies came back to us in clear, crisp tones, expressing their anxiety for our safety.

Shortly after leaving New Egypt, we encountered a change of wind which would have carried us back toward the coast again. Tossing overboard a few pounds of sand ballast, the balloon became lighter and rose to an altitude of 1200 feet. Here was a more favorable wind, and we remained in that strata for a time. Our speed increased in this strata from five to twenty miles per hour. The light of "Billy Penn" on the City Hall of Philadelphia now came to view like a glowing planet in the evening sky, and presented a good point of bearing toward which to navigate.

Soon afterward, a long, silvery ribbon winding along through the moonlit landscape came to view. It was the Delaware River and a little later, near Bristol, we came under its influence. The swirl of air currents above the river were such as to carry the balloon to the southward along its banks. Thus, we found ourselves drifting toward the city of Philadelphia, much as we had planned to do.

As we approached, we rose to an altitude of 2000 feet, and from there gazed down upon the City of Brotherly Love. Like a gigantic be-jewelled spider web it stretched off into distance. Its streets and boulevards appeared not unlike rivers of light. Myriads of glittering lights cast a vivid halo to the sky about us. The silver balloon, with its inscription,—"U. S. Navy"—stood out in beautiful relief as we soared above.

We jockeyed about over the city for a time, and then sailed toward Reading, Pennsylvania. Over Reading, the first signs of impending danger made their appearance. Thick, murky clouds began forming in the heavens, obscuring the moon and enveloping us in darkness. Flakes of snow and sleet began pelting us, and signalled a warning. However, the weather forecast given us by the Weather Bureau before sailing, presaged fair weather, so we anticipated no serious trouble.

Quite suddenly, the wind sprang up in moaning whining fury and we were being hurled through the darkness on a general northwesterly ocurse toward the mountainous district. We tried various altitudes in search of a wind that would

Here is a U. S. Navy balloon in full flight with all of the details visible. Note particularly the net over the sphere, the appendix and the suspension of the basket.

carry us on a more favorable course, but with no success. Every strata of wind seemed to tend toward the North. As a result, we were soon over the dangerous mountain district of Pennsylvania, a territory very unfavorable for landing in a balloon.

At about 2:00 A. M., we ran into a heavy snow storm which obliterated our view of the ground entirely, and prevented us from determining our position or navigating with any degree of accuracy. For ages, it seemed, we hurtled along through cold, clammy ghoulish clouds, not knowing whither or where. The snow began falling more heavily, and with the sleet, was lashed about in swirling fury in the angry gale.

We rose to an altitude of 4000 feet for we estimated that we might have reached the higher mountain district in the black forest region of Northern Pennsylvania. Our safety, therefore, lay in altitude, otherwise, at any moment the gale might hurl the balloon against the rocky cliff on some lonely mountain side. If such were the case, a bounce or two, and it would be all over for the crew, except perhaps the singing and the flowers after we were found!

With a vision of what might easily happen to us, we peered rather anxiously into the uncanny ghostly gripping clouds from which there seemed to be no escape. Here the cold became more intense, the snow caked upon our heavy flying clothes and began filling the basket. At times the blizzard was so severe, that we could not see the balloon above us. We seemed at times to be hurtling through space contained only in the willow basket in a sea of clouds.

Suddenly, the blanket of cloud parted for the moment. A menacing, black mountain peak, scarcely to be distinguished from the gloom, loomed before us. Feverishly, without undue ceremony, we dumped overboard three bags of sand, bag and all, and we rose almost perpendicularly to a higher altitude.

Our drag rope, a heavy manila one about 300 feet long which dangled from the basket of the balloon, lashed the mountain slope in speeding fury. We

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At the end of the trip. The envelope folded beside the basket.

The Potez Is a Novel Observation Seaplane

by FLETCHER PRATT

A side view of the Potez 45, taking off. Note the unusual location of the power-plant and the structural members of the wing group. The centerline of thrust is nearly on the chordal line of the wing.

ONE of the most interesting of the series of new planes being made standard in the French navy is the Potez 45, a brand new two-seater observation seaplane, designed especially for observation and coastguard work in connection with the light cruisers and gunboats of the French navy.

It combines small size and a quick takeoff from the water with high speed, a wide field of visibility for the observer and great seaworthiness, but perhaps the most striking characteristic is the care that has been spent on designing both the machine and its shipping crate for transportation on shipboard where space is at a premium.

The crate which has been as carefully designed as the airplane itself, contains a small door at the top which permits constant access to the motor and thus allows repairs to be made at any time. But this is not all. The crate has special arrangements on its interior, by means of which, with one side opened, the airplane may be entirely assembled and tested while still in traveling position.

By opening the other side it is possible to unfold the wings while the machine is still in its crate and it can then be lifted out by the ship's crane to be set on the catapult or in the water. A special gear in the bottom of the crate locks with trunnions on the plane and holds it firmly in position for the assembly, the same trunnions being used to hold it in position on the catapult when it is to "have a shot."

The most striking features of the design, apart from the foldable wings, are the placing of the motor, the positions of pilot's and observer's seats and the bracing. The motor is placed high up and very far forward to keep the propeller at all times free from spray and the damage caused by it. It is supported on a system of struts entirely separate from the wing and streamlined into it, with the reserve fuel supply carried inside this streamlining and the main fuel lines running up from the prow of the ship through the struts.

Being a high-wing monoplane the visibility is naturally good, but it has been still further improved by placing the observer behind the pilot, giving him a thoroughly uninterrupted field of vision in all directions. The wing is supported by a cleverly designed system of triangular bracing, which also carries the wing-tip floats. This is placed very low to give the machine stability in the heavy seas she is expected to encounter in naval work. The focal points of the bracing system are the socket joints on which the wings fold.

Special arrangements have also been adopted to improve the machine as a catapult plane. The trunnions, which will lock into the standard French navy catapult carriage, are an example of such arrangement. The installation of the engine far forward and high was influenced by this arrangement. In addition, the wing has been furnished with a Potez type wing slot to insure a good lift at a high angle of incidence and thus saves the pilot from being dumped into the sea from the catapult.

The wing is entirely of wood and of cantilever construction with interior bracing. The hull is mahogany with all metal parts reduced to the strictest minimum; four assembly pieces being all it contains. It has a double step to permit easy takeoffs and landings on the water.

The question of disassembly and packing in quick time and in a very reduced space has been especially studied. As a result, all the principal organs of the machine are found concentrated in the nacelle and it requires the loosening of only four bolts to disassemble this portion of the machine.

The equipment of the new machine includes wireless apparatus, a special built-in map table in the observer's seat, a built-in photographic apparatus,

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The Air Corp's Part in the C-C-C

by COLIN K. CAMERON

Just how the U. S. Army Air Corps is assisting in putting over President Roosevelt's reforestation project and how flying officers are now becoming students in woodcraft.

"IT'S THE biggest job—" Major General Benjamin D. Foulois, Chief of the Army Air Corps, was speaking with a number of Washington representatives of national press services.

"It's the biggest job," he repeated for emphasis, "that has confronted us in the entire peace time history of the Corps!"

This biggest job was the Air Corps' part in the President's great reforestation project. President Roosevelt was desirous of putting at least 250,000 young Americans to work in the wide spread forests of the nation. The project was to be in full operation by the first day of July.

An immense task! From April, 1917, until July 1st of the same year, when speed in mobilization was of the most vital importance, only sixteen thousand men had been embarked upon vessels for transportation toward the battlefields of Europe. Now, in 1933, within a similar length of time, it was demanded that *more than fifteen times as many men* should be mobilized and prepared for active service in the field.

"Can the Army do it?" asked the President.

"It's the Army's job!" was the answer of the Chief of Staff.

The Air Corps is a part of the Regular Army, and a mighty important part at that. In this great task of the entire military force of the country, the airmen were scheduled to play a big hand.

They didn't wait for orders, however. Even General Foulois was surprised to learn that before Air Corps orders were issued, officers and men of the flying branch had already put away their dress uniforms, had rolled up the sleeves of their coveralls, and were hard at work on preparations for their share of the job.

—*U. S. Army Air Corps Photo*

The Air Corps cooks appeal to the inner man of the CCC members at Camp Arrowhead, Calif.

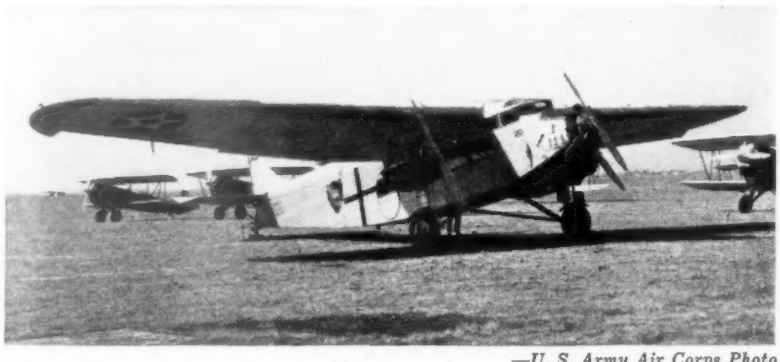
The first thing was the reception at Mitchel Field, New York, Langley Field, Virginia, and March Field, California, of the several contingents of applicants for work with the Conservation Corps. The remnant of the army from the "Bonus Camp" at Fort Hunt, near Washington, D. C., formed a part of the twelve hundred men received at the Virginia station.

On the day following the arrival of applicants at the Air Corps stations, they were examined for physical defects and communicable diseases. To the men not thus eliminated, there were issued clothing and equipment consisting of remodeled Army uniforms, a raincoat, shirts, underwear, shoes, working clothes, hats, socks, toilet articles, a belt and a "barracks bag" in which to carry the surplus.

Then the Air Corps men and officers began to sweat. Physical training as such doesn't play a great part in the life of flying soldiers. Their work, arduous and exacting as it is, supplies them usually with all the physical activity they need to keep them in trim. But orders indicated that the CCC men were to be "conditioned" for their jobs in the forests. So out came the Army regulations on physical training—and then the CCC men began to sweat, too. They worked! But so thorough and careful was the grading of the exercises that it was not long before muscles began to appear in bulk, right where they were going to be needed.

To supply these muscles with fuel called upon the fullest resources of the Air Corps cooks. These men would roll out of bed at *midnight* to begin preparations for breakfast for the growing youths of the forest army. And such breakfasts! Ham or bacon and eggs without stint. One man is reported actually to have eaten *nineteen* eggs at a single sitting! Imagine fifteen hundred or two thousand men with such appetities as that!

But none of this was the "Biggest job" to which General Foulois was referring in his talk. This was just incidental to the main issue. The main issue includes thousands—no, *tens* of thousands of miles of flying into the great national and state forest areas of the nation. It includes the establishment of dozens of airdromes in the wilderness, the arrangement and operation of air ambulance and supply service, the delivery of persons to camps in sections absolutely unattainable ex-



—*U. S. Army Air Corps Photo*

One of the Ford Trimotor ambulances which will furnish rush service to the CCC members in isolated camps.

cept by air, of communication and photographic missions.

And what does photography have to do with the reforestation plans, it may be asked. Well, many of the sections into which the workers have now been sent had never been thoroughly surveyed or mapped. The only way to do the job in a hurry—and to do it right at the same time—was to do it from the air. Accordingly Air Corps photographers who have been trained for war time picture taking were called into service with their multiple lensed cameras and told to get on the job. They did! From their pictures the completed surveys were made, camp sites were picked out, and details for the job in hand—reforestation—were decided upon.

"The Air Corps is behind the CCC project to the limit of its ability," said General Foulois. "We haven't nearly reached the limit yet, however. I believe that not only is the Air Corps going to be essential to the success of the forestry project, but that the Corps itself is to benefit greatly from the task imposed upon it."

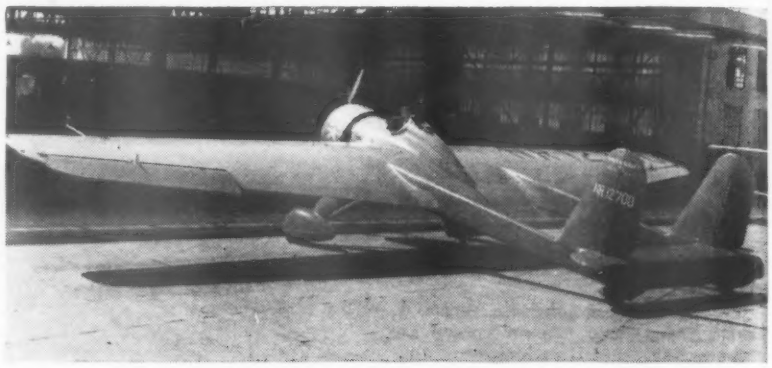
Not only are pilots and observers receiving a great deal of experience in various phases of their work, but mechanical and engineering officers of the Corps are also receiving great benefit. The construction of landing fields in remote areas, planning of which is now under way, will be only a part of this great task of transportation and aid.

The fullest use of the flying service is planned to keep to its lowest ebb sickness, and to maintain morale among the men who are in the more isolated posts. By means of the air service, medical and sanitary inspectors can quickly and easily inspect regularly all workers and camps. In case of emergency, the giant Ford C-9 ambulances of the Air Corps can swoop down, pick up a patient and speed him to a hospital within a period of hours, and sometimes even minutes. This solves one of the great problems of large encampments formerly experienced.

The editor of POPULAR AVIATION has given me but a thousand words in which to tell of the work of the Air Corps in the President's project. A thousand words! Even now, several chapters could easily be written concerning the portion that is already history. By the time the CCC Camps become themselves history, the chapters will have expanded into a two or more volume book. The results of the plans sketched out above, to say nothing of other plans now under way, may easily involve, according to the Air Corps Chief, the ordering into CCC service of every available officer, man and plane the Army Air Corps has or will have.

EDITOR'S NOTE! *While the construction of new landing fields, reforestation and the employment of many men is a most praiseworthy undertaking, yet we believe that this hook-up with the Air Corps will not improve the flying ability of the Air Corps pilots. The CCC should be officered from some other branch of the service.*

Clare Vance's Flying Wing Stands Idle



Showing the peculiar but efficient outrigger arrangement of the Vance express and freight plane.

FOR months, the plane has been idle, equipped and ready for a pilot to take it off on a record-breaking distance flight. In its great tanks are a thousand gallons of gasoline and 50 gallons of oils. Even the charts for the flight are in the cockpit.

But the hand that was to guide this flying wing all-metal monoplane, is forever stilled. Claire Vance, mail pilot, who designed, built and tested the ship, was killed one stormy night last summer flying the mails through the Rockies.

The machine is in the United Air Lines hangar in Oakland, Calif. Vance devoted three years to the design and construction of it, building it from models whittled out of wood while he flew the mails across the mountains. It is powered with a supercharged Wasp motor, and is capable of taking off with a load of 1,200 gallons of fuel.

In tests, it showed a top speed of more than 200 miles an hour, a cruising speed of close to 160 miles an hour. Its ceiling is 36,000 feet. Once Vance took it off with an 800-gallon gas load and 50 gallons of oil after a run of 1,500 feet. Its tests indicate that it has a non-stop range of 7,800 miles.

The pilot's widow owns the plane. She expects to sell it in the spring to one of several competent pilots who have flown it with Vance, and an attempt at the distance flight record in the ship this summer is probable.

Here's Is a Fine Looking Old Ship

IF YOU should ask any of the old-timers, "what was the best looking ship produced during the World War?" many of them would answer, "The LePere," or more particularly, "the Packard-LePere."

And they will go further and tell you that the old Packard-LePere was "one of the sweetest flying ships of the time." Clean cut, neat and trim, with due observance to aerodynamic detail the LePere stood out in contrast to the majority of the ships of her period.

One of the most prominent features of the design was the "portal type" of interplane bracing.

Side elevation of the Packard-LePere two-seater which has remarkably clean lines.

What Inventors Should Know

by JAMES FERBER

Most inventors, with an aeronautical complex, have been greatly worried as to the final disposition of their invention after it has been completed. Mr. Ferber makes all of the important points crystal clear.

EVERY imaginative person has at some time or other in his life conceived the mechanical answer to a problem that, in the form of an invention submitted to the United States Patent bureau, might have made his fortune.

This statement is not to be construed as an encouragement to everyone with an idea to spend time and money in getting it patented and marketed. But it is intended to encourage those who have sufficiently developed an idea to warrant such steps to be taken as will prove or disprove its commercial or military value. For it is a fact that there has been many an idea that has laid dormant while another fellow goes ahead and gets places with an invention born of the same thought.

I am presenting, through this article, the facts about the matter of inventions—what to do with one after you get it—what happens to it after you submit it—where and how to submit it—the financial rewards reasonably to be expected—and some pointers of value to those who tinker and toil, as well as those who feel they have something of real value and desire accurate guidance.

The true artist or inventor, professionally speaking, often is not concerned with the financial rewards of his brain child. But since many worthwhile mechanical creations are not the mental fruit of the professionals, it might be a good plan to investigate the comparative rewards of governmental and commercial agencies handling inventions.

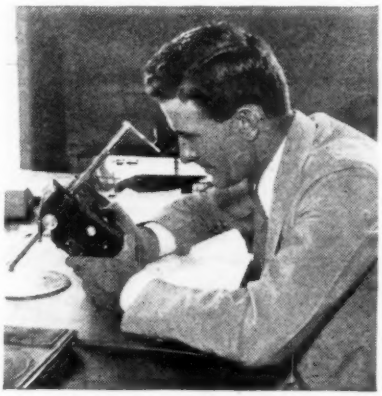
For the purpose of being strictly accurate, it is necessary to point out what you may already know, namely, that the United States Government is not as lucrative an agency as a commercial outfit. The reason is that the government is limited in its appropriations and that the inventor does not have to consign exclusive rights to the Government, while still getting a fair price for his invention.

The definite money award limit placed on aeronautical inventions is $75,000. An act of Congress approved July 2, 1926, and amended by an Act approved March 3, 1927, provides that "the Board (of Patents and Design of the National Advisory Committee for Aeronautics) shall fix its (the invention's) worth to the United States in an amount not to exceed $75,000."

It can be seen, that with such a limitation placed on the money value of an invention of aeronautical character, there is more reward possible with commercial concerns.

SUPPOSE, for instance, that you were Handley-Page, and had invented the "slot" for airplane wings. Had Mr. Page, a citizen of Manchester, England, offered this revolutionary invention to the United States Government, he could have received no more than $75,000 for it unless (in accordance with the same Act of Congress referred to above) he had assigned exclusive license to our Government under the law.

Despite the fact that the "slots" are scorned by flyers in many instances, they do have great commercial value



Harold Gatty, of 'round-the-world' fame, is employed by the government to work out his navigational instrument invention.

and certainly some military value, as the United States Navy ascertained after many tests. Such an invention was worth a half million dollars to Mr. Page and as a result of his business acumen, it is likely that his earnings from "slots" have already exceeded the reported figure of $750,000!

The Government is not in the business of manufacturing engines. Power plants for Government aircraft are purchased from private corporations. They are tested rigorously and often improved upon—but the profits reaped from perfection of a new carbureter, for example, would probably be greater if submitted to the makers of engines, such as Pratt & Whitney or Wright Aeronautical Corporation.

So much for the financial rewards of the Art of Inventing:—the Government can match reward for reward with commercial companies up to $75,000 (although it is probable that Government economics would place a lower dollar interpretation on invention value up to this maximum).

The sky is the limit with private corporations if they find something they want and feel they must have. The Government misses many opportunities because of this fact, although sooner or later it derives benefit from private corporation experiments through appearance of new devices on contrivances sold to it.

After you have invented something, your next thought is probably What Should I Do Now?

We can dispose of the commercial side in very few words:—

Pick the company with the best reputation, best laboratories and best financial rating and submit it direct. You may be assured of one thing that you have often wondered about:—your invention will not be overlooked.

It will be received and acknowledged. Then it will be sent to the laboratories of the company where engineers will work with it. If they perceive that you have an idea but have failed to express it or to explain it, they will bend every effort toward its development and exploitation.

They will not steal your idea. Many inventors are concerned about this, and with some justice, too. Having an idea stolen is one of the greatest thorns in the side of creative genius.

But the best corporations are above this. It is not necessary to steal what they want. They have the money to step into the market and buy what they want and need not depend on theft to improve themselves mechanically.

One more reason for you to regard corporations as "steal-proof" is that the practice might lead to expensive law-suits which might prove costlier in the end. The history of American industries, proves that point.

Submit your invention, then, to the best manufacturer in the field and you will get a square deal. The profits are large to you, although to a corporation expecting to make considerably more due to its ability to finance such an operation, the inventor's remuneration is a very much worth while and relatively inexpensive investment.

There are no rules or regulations governing the submission of inventions to private companies for consideration. Simply box it up together with your engineering conceptions of it, and send it along.

MANY persons feel, however, that the United States Government offers many advantages over the in-

dividual commercial enterpriser, and there is much basis for such a belief.

If there is any fear for the loss of an unpatented idea, the Government offers haven and refuge to the inventor. The Government is not interested in getting an invention until all rules and regulations have been complied with and it is legally relieved of further responsibility to the inventor. The Government has learned that it is often too easy for individuals to cash in on technicalities, you see.

Hence, in submitting your idea——patented or unpatented—you are sure of two things—it will be most thoroughly tested and, (in the case of unpatented ideas), it is safe from the idea-thief.

Suppose you live near a government air corps or Navy Department post.

If you reside in Chicago, the nearest U. S. Army Air Corps post is the Municipal airport where Government machines are always landing, or taking off or being stored. There is a representative of the Air Corps there.

Suppose you are a resident of New York City—Mitchell Field, near Garden City, Long Island, is handy, and always has a large staff or Air Corps officers in charge. Go to the nearest post. Officers in command will receive you and will issue receipt for your invention. And you may leave the post assured of the fact that your product will be quickly forwarded to the proper authorities.

Or, if you live near Anacostia, run out to the Naval station and take your invention with you. If you live in Florida, go to Key West where Naval officers will be ready to aid you. Or San Francisco or any other city, town, or port where the Navy is officially represented—you may present your invention and rest assured that it will get into the proper hands.

I have the written communications of the Chief of the Army Air Corps and the Bureau of Aeronautics of the Navy Department. Both Government agencies have expressed their desire to have aeronautical inventions submitted. And in each case, the invitation to submit inventions, officially issued, has been cordial and sincere.

Something different in wing slots was on the mind of this inventor, but he lost out in the battle for reasons explained in the text.

The official policy of the U. S. Army Air Corps, as expressed by Brigadier General O. Westover, Asst. Chief of the Corps, is as follows:

"The Air Corps is interested in any invention which will enable it to provide improved equipment for the service. Aeronautical inventions thought to have military value should be submitted to this office for consideration."

The Chief of the Bureau of Aeronautics, Navy Dept., says virtually the same thing in regard to the submission of aeronautical inventions for consideration of the Navy.

Thereby, you are assured of your reception by these two Government agencies. They welcome new ideas and inventions because they feel that among the many presented there will be some that will stand the gaff and go through.

However, the chief of each of these departments is answering your question in the only way he can:—he is glad and willing to receive an invention on behalf of the Government. The fact of the matter is, that under existing regulations, it would be the best plan to submit your invention direct to the group of men who will receive it any way, and whose words and dictums are the final say-so. This group is called the National Advisory Committee for Aeronautics, which we will henceforward refer to as the N. A. C. A., or as the Committee.

Although the chiefs of the Air Corps and the Navy aeronautics bureau signify their interest and willingness to receive inventions, thereby assuring you of the co-operation of any post in the nation representing either of these departments, there is a more direct route to the center of Government aeronautical inventions activities, if the weight, bulk or characteristics of your invention make it possible for you to take that route.

Send it direct to the N. A. C. A.

Whether you turn in your invention to Chicago, Mitchel Field, Anacostia, Key West, San Francisco or Wright (the latter having one of the greatest test laboratories in the world) your submission will reach the N. A. C. A.

THERE are at present, 14 members and a secretary serving on this all-powerful Committee. They are:—Dr. Joseph S. Ames, Chairman; David W. Taylor, vice Chairman; Charles G. Abbott, Capt. Arthur Cook, U. S. N.; William F. Durand, Maj. Gen. Benjamin D. Foulois, Chief of the Army Air Corps,; Harry F. Guggenheim, Rear Admiral Ernest J. King, Col. Charles A. Lindbergh, William P. MacCracken, Charles F. Marvin, Brig. Gen. Henry C. Pratt, Edward P. Warner, Orville Wright, and J. F. Victory, secretary.

All these men serve without compensation and their work throughout the year which brings them into intimate contact with all branches of aeronautics is monumental.

Aeronautical inventions should be addressed to the Chairman, Aeronautical Patents and Design Board, War Department, Washington. It is through that Board that your invention must pass before it is turned over to the N. A. C. A. for consideration as to its merits. This means that even though you turn over your model, data and description to the nearest Army or Navy post, it will proceed through government channels to the above mentioned Board.

This provides a preliminary survey of the invention before it is turned over to the N. A. C. A. A further study of the offering is made by a subcommittee called the Committee on Aeronautical

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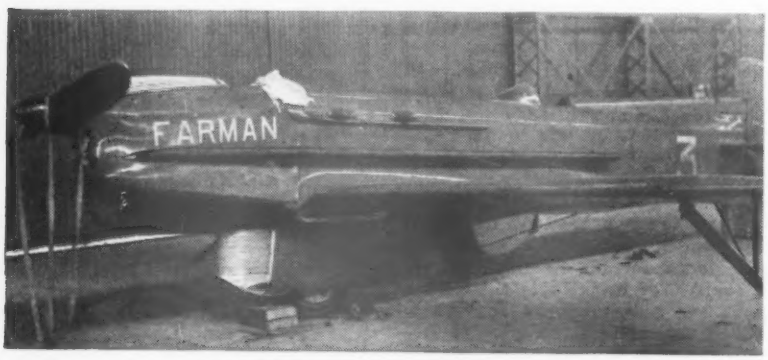


A side view of the new experimental Farman Monoped, developed by a noted airplane inventor.

A Crackup in a Hog Pasture

by WILLIAM L. HOPSON

In which Mr. "Pigs" Jackson, barnstormer, and his inamorata try strafing the hogs and are strafed in return. The moral to Mr. Hopson's tale is, "Leave them air hawgs alone."

I'VE MET a lot of screwy pilots during the five years that I drifted about the country doing chute jumping, wing walking, and rope ladder work. And since there was no such thing as an inspector in those days, and a flyer's only guide was his conscience, it's a darn wonder that more of them as well as a larger number of passengers didn't get wiped out.

If a pilot took a notion to get drunk and fly—and a lot of them were full of notions—then he got drunk and flew. If he wanted to try rolling the wheels of his Jenny or Standard or Canuck or "Tommy" off the roof of someone's barn, then he tried it. Certainly there was no one to stop him.

And that gets me around to the history of the honorable Mr. "Pigs" Jackson and how he came to get such a sweet smelling sobriquet.

When the red-headed Mr. Jackson was first born (he didn't have any hair then) he was christened Albert Jarvis Jackson in honor of the proud father. Then young Mr. Jackson began to grow up, started to school and after spending a couple of years in the sixth grade, decided that he didn't need an education. A few years later he drifted into the flying game.

He was a long, lanky freckle-faced cuss and his only interests in life seemed to be: First, airplanes; second, liquor; third and last—women. But how that red thatched hombre could handle a ship!

Things hadn't been going so good with me, with the result that I was broke and riding the side-door Pullmans; so you can imagine my feelings one morning when the freight stopped and I jumped out of the car to see in a field, not three hundred yards away, a yellow-winged five-place 180 Hisso Standard. Oh joy, oh joys! EATS! With the canvas bag containing my parachute gripped under one arm I headed for the field and it was there, a few minutes later, that I met Mr. Jackson and his flying partner, a fellow named Tommy Walker.

Mr. Jackson and Tommy were as glad to see me as I was glad to see them. Over a plate of ham and eggs, they volunteered the information that they had just started out to barnstorm a couple of days before, and if I wanted to hook up with them for the summer, they'd be glad to have me with them. You can be sure I accepted.

We spent the next three weeks or so barnstorming through the state, stopping in at any little towns that looked as if they might yield a few dollars. All of us made fair wages. Then, one morning, we filled the gas tanks and took off across country for Crosby, a little town up near the Canadian line.

Everything went along fine until we were about ten miles short of our destination and then the sweetly singing Hisso suddenly got a bad case of asthma and began to cough. We were breezing along at 1,200 feet altitude at the time. She gave a couple of "sputt-t-t's," a grunt or two and finally conked out completely.

Tommy and I were riding in the big four-place pit up in front and as the unconcerned Mr. Jackson cut the switches and nosed down, Tommy turned around and yelled,

"Well, what'n the blazes is the matter with her now?"

"Sounds like a plugged gas line," hooted back Mr. Jackson above the singing of the wind through the flying wires. He gave Tommy a reproachful look. "I've told you not less than a dozen times you oughta strain that gas through a chamois skin. Mebbe, next time, you'll pay some attention when I tell you somethin'." He poked his head over the side and began to search the ground below for a smooth and large enough place to set her down.

He sure didn't have much from which to choose. Although the ground was fairly level for miles around, it being a farming district, it had been fenced off into so many small pastures and fields that it had the appearance of a monster green and brown jig-saw puzzle. To make matters worse, those very few places that did look large and level enough to land on were generously sprinkled with small boulders.

Then Tommy let out a yell and pointed to a small plowed field a few hundred feet off to one side. "Set her down in that one, Ab—it's our only chance."

"Don't you do it!" I shouted back to our pilot, pointing to a small rocky pasture over on my side of the ship, "Over there is the place to land."

Mr. Jackson took his attention from the manipulation of the controls long enough to glare belligerently at both of us.

"Say," he bawled indignantly, "just who in the — — — — is flying this blasted crate, anyway?" Who were we to tell *him* where to land! He kept nosing down and shooting straight ahead and me and Tommy soon saw the reason. About a quarter of a mile ahead and below the ship were the buildings of a prosperous looking farm, and right beside them was a long narrow strip of level pasture. It was about one hundred and fifty feet wide and possibly three hundred yards in length. Mr. Jackson swung the ship in a short circle, nosed down sharply and side-slipped in

"Here's where I eat once more," sez I, as I stood on the deck of the tottering crate.

over the fence at one end of the pasture.

I heaved a big sigh of relief, looked out over the side—and my heart almost stopped functioning. I blinked and looked again. Ye gods! We were sitting down in a *hog pasture!* And they were running in every direction! Big hogs; little hogs; red hogs; black and white hogs. They evidently had been lying in the shade of the trees that lined one side of the pasture—but now they were legging it down the field.

Hogs to the right of us,
Hogs to the left of us,
Hogs in front of us,
Grunted and thundered.

I don't know yet how we managed to get down without scrambling a grunter or two; but get down we did—to the tune of hogs still running and "woofing." Some of them would run a few steps, turn around for a look, then give a couple of "woofs" and off they'd go again.

Mr. Jackson crawled from the cockpit and sniffed the strong smelling atmosphere. "There you are," he said blandly, waving an airy hand; "nothing to it when you know how." Then he turned his attention to an excited farm wife and her husky daughter, of about twenty-two years, who came galloping out of the farm house to the pasture.

"Land sakes alive!" cried the puffing mother, wiping her red face with the apron about her waist. "What in the world do you aviators mean by landing that flyin' machine in our hog pasture?"

"There's nothing to get excited about, Lady," soothed Mr. Jackson. "We just had a little motor trouble and had to set down. Nobody is hurt—not even a hawg."

Tommy and I went to work on the motor, while Mr. Jackson took it upon himself to explain to the mother and daughter all there was to know about flying. We soon found that he had been right in his guess about the clogged gas line. We took out a section, blew out a small wad of lint and dirt and started putting it back in place.

While we were doing this, Mr. Jack son showed the mother and daughter, —especially the daughter,—the inside of the cockpits, how the controls worked, what the rudder was for, and what made the plane fly. About every two minutes he'd have to stop in the middle of a lecture to holler "SOOIE!" at an inquisitive porker or two that had ambled over to see what it was all about.

We had just finished replacing the section of gas line and turned on the gas to the carbureter when more trouble of a different kind landed on us with a vengeance. It came in the shape of an individual about fifty years old whom, I judge, had been plowing in a distant field. One good look at him convinced me that the master of the house had arrived. He piled over the hog pasture fence and with several

(*Concluded on page* 54)

The Aero-Sportswomen

by JOAN THOMAS

CONGRATULATIONS are in order. The "99'er" has grown up!

Starting in October, 1932, under the direction of Amelia Earhart, then president of the "99" (official organization of women pilots) the "99'er" has been ably edited by Clara Studer of New York. For the past year it has been issued in a mimeograph form as a monthly news letter, but on November 2, 1933, the fourth anniversary of the founding of the Ninety-Nines, it appeared for the first time as a printed pamphlet.

It is an attractive little magazine and will be of great interest to all women who are interested in aviation, whether members of aeronautical organizations, employees of the industry, passengers of air lines or women pilots.

In this issue of the "99'er," Margaret Cooper, recently elected president of the 99, issued an invitation to all women qualified to fly in any country, to join the organization. Incidentally, since the change in requirements has gone into effect, student pilots holding letters of authority to fly cross-country are eligible.

As a member of the "99," the editor of *The Aero-Sportswomen* heartily approves of the plan to invite the women pilots of other countries to become a part of the organization. It is one way to help promote better understanding and international relationship. As we all know, trans-oceanic flights and good-will tours made by various famous aviators, have done much to nullify the ill will incurred by political differences and misunderstandings. And so, we feel that a strong international bond between women flyers will be of some effect, and may help overcome the growing spirit of fanatical nationalism, that seems to be developing out of the present economic situation.

* * *

THAT there will be a regular trans-Atlantic air service is an accepted fact. But just how soon, or whether it should be with heavier or lighter-than-air machines is yet to be solved.

However, Miss Dorothy Ruegg, who traveled from Rio de Janeiro to Akron, Ohio, votes for the airship as the most fascinating way one could possibly travel.

Miss Ruth Nichols attended the Century of Progress in company with the editor of this column (right).

"We left Rio about 6:30 one morning," she said, "and arrived at Pernambuco at 7 o'clock the next morning. We were there all day. The take-off that evening was perhaps the most impressive moment of the whole trip, a large crowd of people had gathered at the flying field and as the ship was released they burst into song. Then as we floated upward, the music became fainter and fainter.

"We flew at different altitudes, for instance, when we were over the Caribbean sea we were quite high. It was perfectly calm up there, but there must have been a terrific wind at sea-level as we could see the boats tossing wildly. It seemed so strange, for we were sailing smoothly along without even a quiver.

"Then, when we were over the jungle, we flew quite low at about a 300 foot altitude, I should judge. We could see the alligators in the rivers and the brilliant colors—scarlet, green, yellow and blue of the tropical birds flitting through the trees."

Travel aboard an airship is not unlike that on a steamship. The passenger's cabins are quite similar, with bunks and hot and cold running water

(*Concluded on page* 65)

A party held at the home of Miss Marguerite Green for the members of the Chicago Chapter of the Women's National Aeronautic Association was enjoyed by those fortunate enough to attend.

The Future for Aviation Engines

by GLENN D. ANGLE

Further predictions in airplane engine design by this noted author. Differences in future engines will not be radical differences but refinements of present basic principles.

PERHAPS it would be well to briefly refer to further improvements in air-cooled cylinder construction, which will be effected, no doubt, from time to time in the future. While many engines employ cylinders representing the highest stages of development at the present time, there are still several using fairly crude constructions—particularly the valve-operating mechanism, where there is always much room for improvement.

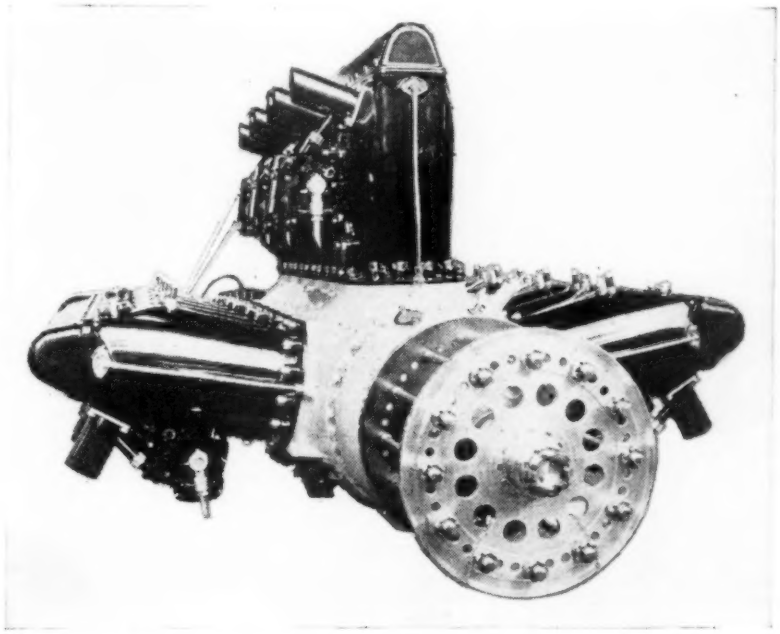
The customary composite construction, with aluminum cylinder head and steel barrel, bids fair to remain first choice for some time to come. There will naturally be many refinements as experience dictates the necessity or advisability for them. For small engines, where price is often a factor of greater importance than weight, one-piece castings of iron with a nickel or molybdenum content have frequently been used.

While properly designed cylinders of this class cool very satisfactorily in sizes not exceeding, let us say, 4.5 inches bore, it is rather likely the excess weight and possible foundry losses will make this construction unattractive as simplified and less expensive composite constructions are developed. Of the two common methods used for attaching the cylinder head to the barrel in the composite type; namely, by screw threads and shrink, or by bolting together, the latter is least used and is found only among the smaller designs. However, it will gain in popularity because of its lower costs when more manufacturers learn how these joints must be constructed.

Thus far, the term "liquid-cooling" has been used in order to adequately include all engines of this classification. Until not so long ago, liquid-cooled types were regularly referred to as water-cooled engines, as water was the only cooling medium employed. Since the introduction of Prestone, or other liquids having a higher boiling point than water, the broader term is more appropriate.

We shall not devote a great deal of space to an explanation of the features in the use of these special cooling liquids, as much has already been written regarding them. It is sufficient to merely direct attention to the fact that they permit of higher safe operating temperatures, and as a result an engine usually has greater thermal efficiency.

Besides, the system may be sealed since there is no loss due to boiling and, because of the increased cooling efficiency resulting from a greater temperature difference between the liquid and cooling air, a much smaller radiator may be used, as well as considerably less liquid in the system. Obviously the reduced weight and drag in such installations recover in some measure the advantages previously held by air-cooled designs over water-cooled engine installations.



An 18-cylinder French aviation engine with six cylinders per block and with an included angle of 80-degrees between the blocks.

While several applications of the use of this new cooling medium have been made, the development process has been slow due to the changes required in existing engines which were originally designed for cooling by water. With the design requirements determined, it will be possible to incorporate them in new engines that are developed in the future and thus take full advantage of all the features involved. There have naturally been some difficulties encountered in the use of cooling liquids of high boiling points, but these problems will eventually be solved, if they haven't been already, and we should see a wider use of this method of cooling in the future. The application thus far has been in a power range now dominated by the air-cooled types, so we cannot expect to see many applications of this sort until engines in the higher horsepower class are constructed.

IT IS not anticipated that there will be any radical departures from existing types of engines of less than sixty horsepower, which are usually employed in a single or two-place airplanes of light wing loading. We may expect to see an increase in the use of the two-cycle engine in this particular field, but otherwise the majority of engines of displacements not greatly exceeding one-hundred cubic inches will be four-cycle air-cooled two-cylinder horizontally-opposed types, and up to about two-hundred and fifty cubic inches the three-cylinder air-cooled radial type will prevail.

Neither of the forms mentioned are wholly satisfactory because they do not function as smoothly as power plants for aircraft should, however, cost and weight limitations at present do not permit the construction of engines having a greater number of cylinders. The four-cylinder opposed engine, which is in reality a double form of the two-cylinder type, offers some possibilities in so far as costs, weight and smoothness of operation are concerned, but the problem of cooling the rear cylinders is one requiring more attention than it has received in the past if this arrangement is to survive.

The reactions of the torque delivered by these small engines is more uniform

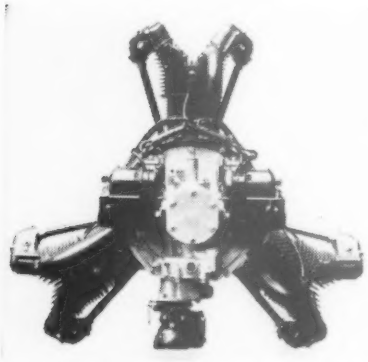
at higher crankshaft speeds, so it generally proves advisable to turn them as fast as good propeller efficiency will permit. Reduction gears would be advantageous, but added cost and weight make these almost prohibitive, in fact, one could just as well build an engine with a larger number of smaller cylinders.

The manner of mounting these small engines is an important factor in the resulting smoothness of operation, particularly the three-cylinder radial whose piston inertia forces are inherently unbalanced, and we may expect many improvements in this direction in the future. The generous and wise use of rubber insulated mountings will often make a vast difference in engine vibration, and designers will undoubtedly devote more attention to these features hereafter.

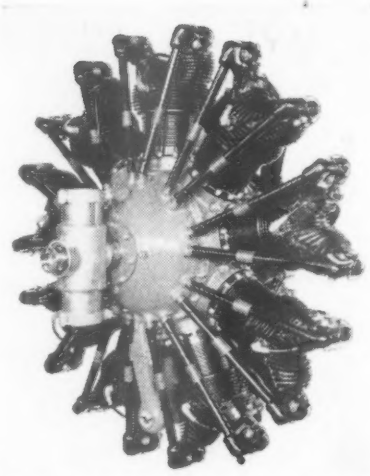
There has been too great a tendency on the part of designers in the past to sacrifice quality and efficiency in these small units in order to reduce their manufacturing costs. This does not prove to be good economy in the long run, and it is sincerely hoped the wisdom of maintaining standards of quality comparable to that employed in larger engines will be more in evidence among all new products in the low-horsepower field in the future.

Some designers pay too little attention to cooling, especially when constructing cylinders of the L-head type. Apparently they do not take into account the slower flying speeds of the light ships, which do not provide as much cooling blast upon the cylinders as do the larger and faster airplanes. I think the aim among experienced engine designers in the future will be to build more durable small units, and reduce costs by means of simplicity in design and construction, as well as through improved production methods.

IT WAS stated earlier that aircraft engines delivering up to three-hundred or four-hundred horsepower should be of the air-cooled variety, and the writer desires to add that, in his opinion, they should also be of the radial type of either five, seven, or nine cylinders. Space will not be devoted to a detailed explanation of the reasons for such an opinion for the benefit of those who favor the in-line type air-cooled engine, since the author's views were covered in a paper, entitled "Radial Versus In-Line Engines," presented before a meeting of the American Society of Mechanical Engineers held in St. Louis during May, 1929. Nothing has occurred since in the nature of new developments to warrant any changes or modifications in the opinions expressed.



The 3-cylinder Aeromarine AR-3, which develops 50 h.p. at 2125 r.p.m.



The Pratt & Whitney Wasp C-1, a 9-cylinder radial of 450 h.p., air-cooled.

The comparisons of the two types were mostly drawn upon rather obvious engineering facts, although it was impossible then (and still is for that matter) to determine the relative drag or head resistance of the two types by comparing their projected frontal areas. It is the opinion that, since an engine requires the circulation of a given number of cubic feet of air per minute per horsepower for adequate cooling, more resistance is set up in properly deflecting it about the cylinders of an in-line engine than by a radial whose cylinders are uniformily exposed to the air blast.

Besides, the use of anti-drag cowlings on radial engines has materially reduced the drag which many believed to be so objectional. Without a decided advantage in head resistance on the part of the in-line type, it is stripped of the principal feature upon which its development was apparently justified, and once these facts are accurately determined by wind-tunnel tests, we may expect to see less activity in the future with engines of this form.

It is not intended to convey the thought that radial engines, in their present state of development, are not without need of refinements. On the contrary, there is much to be done in reducing frontal areas and eliminating unnecessary projections which cause head resistance and reduced flying speed. The mere presence of the in-line engine, with the claims that are made for it, will force the designers of the radial type to devote more attention to matters of this sort. It is expected that radial engines during the next few years will show a much cleaner appearance than heretofore, with particular attention being given to valve gearing, and to the effectiveness of streamlining when mounted in the airplane.

Among the larger radial designs, of three or four-hundred horsepower and up, it would seem that the large overall diameters might offer a great deal of head resistance, and yet, some of our fastest military pursuit airplanes are powered with engines of this type. There are practical limits, of course, and the writer believes diameters of fifty inches or more should be avoided as far as possible, otherwise the engines project too far beyond the outside of the fuselage or nacelle to which they are mounted. The fact that manufacturers are developing the two-row types in the larger outputs is evidence that the largest practicable outside diameter of the single-row design has possibly been reached or exceeded. The writer has long been of the opinion that the two-row type was deserving of more attention from the standpoint of reduced diameters, and it is even expected we may soon see developments of this sort among engines of lower output.

Some manufacturers have turned their efforts to the development of air-cooled Vee types, with the evident purpose of producing an engine offering less drag and greater visibility than a radial type of similar output. By the same method of reasoning employed in comparing the in-line and radial engines of lower outputs, we cannot place great hopes in engines of this class for the future.

American designers have confined their efforts mostly to the air-cooled radial during the past few years, and have thereby developed satisfactory engines of outputs far beyond what would have been considered practicable in this type only a few years ago. European designers, on the other hand, have divided their efforts between air and liquid-cooled developments and as a result have available engines of the latter type with which there are few domestic designs to compare. They have also greatly out-distanced Ameri-

(*Concluded on page* 58)

A 2-cylinder "V" air-cooled engine, one of the lightplane atrocities.

A Super-Airport Proposed

by CHARLES H. DORR

A description of an air-terminal proposed for New York that will operate in conjunction with steamers, railroads and pneumatic tubes, thus solving the airport problem for that densely settled city.

A SUPER-AIRPORT for New York, with an immense airplane landing field, large enough for a fleet of aircraft to make a landing and of such vast proportions that an ocean liner may dock and land passengers and mail beneath the structure, has been designed by Messrs. L. Andrew Reinhard, and Henry Hofmeister, architects, in collaboration with Commander Frank M. Hawks, noted aviator.

Within five minutes of the arrival of ocean liners or high speed airplanes, passengers may be landed and mail distributed from the airport to the heart of New York city.

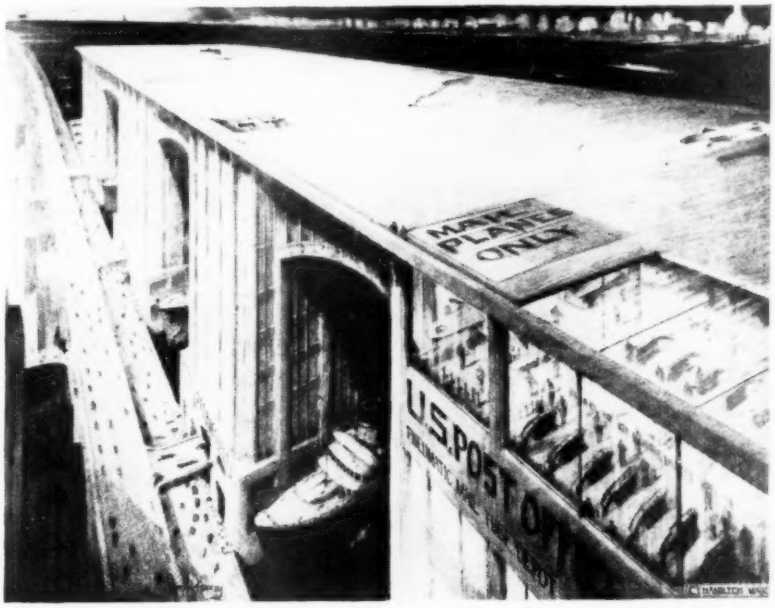
The mail will be distributed through the pneumatic mail tube system immediately after its arrival from distant cities of the United States or Europe, and it is estimated that this can be accomplished with a vast saving of time. It is believed by the designers of the new airport, which has many novel features that it will prove a solution for New York's airplane problem.

It is estimated that the gigantic airport, with its landing field, will be about two thousand feet in length and about eight hundred feet wide, allowing a landing for all types of airplanes under every weather condition.

Plans of the designers call for a series of great dock structures some two hundred feet in height and topped by a landing field of vast proportions. The entire project, as planned, will include a shipping, rail and airplane center, which can be made self-liquidating. Revenue would be derived for a period of years from fees obtained from many air services and the various shipping lines which would connect with the airport.

Another source of revenue would be secured from the gigantic piers with their office rentals for exporters and importers, from bonded warehouses storage depots and even manufacturers who would be able, by availing themselves of the facilities offered by this modern airport, to land their goods directly upon the steamers about to sail for Europe or South America, saving time and the expense of transportation through the streets of New York.

The largest ocean steamships, it is stated by the designers, would be able to land their cargoes and passengers in the slips beneath the elevated airfield, which will be so constructed as to allow a transfer base for travel by air or sea. Passengers on an ocean liner, just docking from Europe, will be able upon landing to take immediately an airplane for any part of the United States without delay or loss of time in travel. No obstructions of any kind will be built upon the surface of the landing field so that it will be free and clear for landing by day or night.



This is the super-airport designed for New York by the architects, L. Andrew Reinhard and Henry Hofmeister in collaboration with Commander Frank M. Hawks.

The project, as outlined by the designers and with the approval of airplane experts, bids fair to revolutionize airplane landings and connections for rapid transit between ships of the air and the sea. One of the most important phases of the plan is the rapid handling of incoming and outgoing mail, a problem that has baffled aviation authorities for some time.

It is planned to operate a series of high speed pneumatic mail tubes which will permit the rapid distribution of airmail from the elevated airport to the city post offices of New York. This plan has been formulated by George J. Murray, Vice-president of the American Pneumatic Tube Corporation, operators of New York's fifty-seven miles of underground pneumatic mail tube systems which handle some six million letters daily.

Through this system air mail landing by planes will reach its post office destination in about five minutes after landing. Mail arriving on Trans-Atlantic liners from abroad will be shot up to the post office depot and placed aboard airplanes for various destinations in the United States.

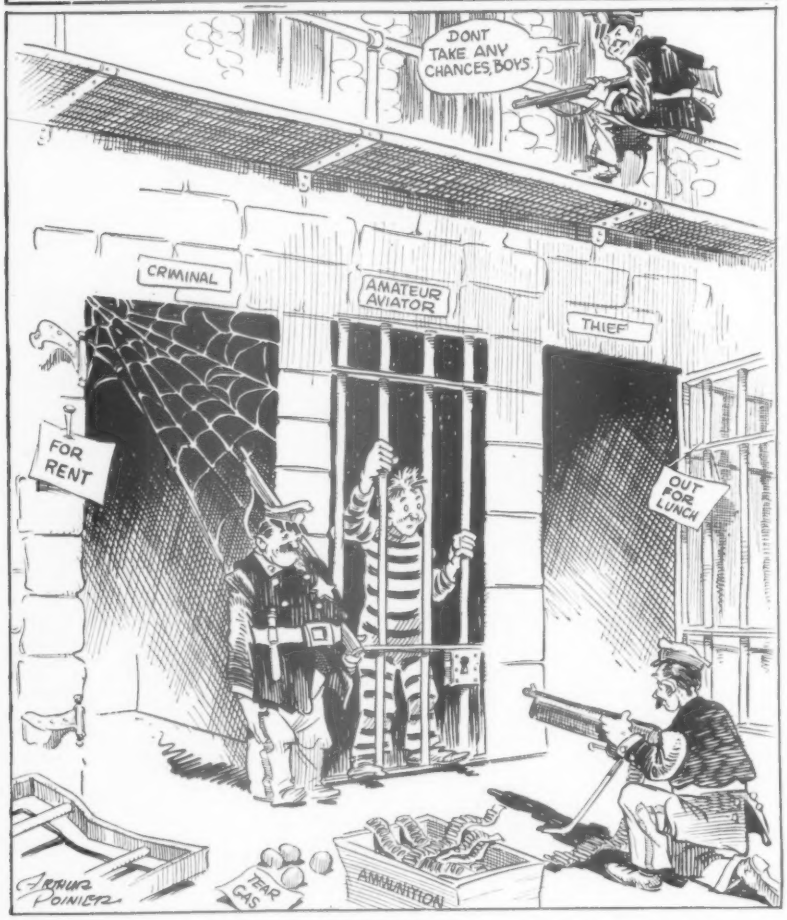
The plan also provides for the lowering of passenger and mail planes by elevators to mail rooms and waiting rooms beneath the great landing platform. All incoming planes will be lowered upon landing to an enormous waiting room located directly beneath the landing field.

From this point, passengers will embark on elevators to various levels, reaching shipping offices, hotels, restaurants, bus terminals, railroad levels and even ocean liners. The mail planes will be provided with a series of elevators going direct to the mail rooms and hangars, according to the plans.

Commander Frank M. Hawks, who has given extensive study to this scheme, declares that it is perfectly feasible. "I see no reason," he says, "why the next steps in aviation should not keep step with actual flying itself. Landings have been conducted by the Navy for years on areas one-fifteenth the proposed size of this field, namely on ocean airplane carriers. By using newly invented facilities for stopping, planes can land and stop within less than three hundred feet."

And this is not only applicable to New York's aviation requirements but it can, in modified form, be worked in every major city to advantage. It does away with the old difficulty of transferring passengers from the city to airports located as far as 20 miles away. Chicago would benefit materially.

Into the Jail-House He Must Go!



America's experimenters and budding airplane designers, are now herded up with criminals and other miscreants just because they have committed the colossal crime of building their own ships and flying them in defiance of doubtful laws. How long must this abomination continue?

WASHINGTON State's anti-private-flyer aviation law has sunk its teeth into the person of its first victim. Ross Peters, 28-year-old automobile mechanic, has been convicted in a Seattle superior court on charges of flying without a license in an unlicensed single-place ship.

Peters was fined twenty-five dollars in Judge Howard M. Findley's court. Unable to pay the fine, he was sent to jail to serve it out. Judge Findley expressed regret that Peters could not afford to appeal the case to the state supreme court so that a test on the constitutionality of the law could be obtained.

This state's law requiring all ships and pilots to be licensed by the Department of Commerce was passed in 1929; but no attempt has ever been made to enforce it until now. Last summer, Peters took off from Boeing Field, Seattle, in a home-built Lincoln sport ship. The authorities were not greatly worried by Peters' little single-place job. But Donald Graham, "state governor" of the National Aeronautic Association (which has as its avowed object "to foster and encourage" sportsman aviation) immediately brought the charges that resulted in Peters being sent to jail.

Peters contended that the Department of Commerce refuses to license ships that are not factory-built, and that therefore the state law requiring that all ships be licensed, no matter for what they are used—is unconstitutional.

But, this being the first case of this nature to come up in the state, the law itself can only be tested by an appeal to the state supreme court. Although Peters was unable to appeal, several students of the law have conceded that he would have stood a very good chance of knocking out the law for good had he been able to take his case to the higher court.

EDITOR'S NOTE! *It is too bad that this conviction could not have been made the subject of a test case, which undoubtedly would have settled the matter once and for all. The contest could have been conducted with little expense by some association believing in clean sportsmanship and in the future of private flying and aeronautic liberty. Too bad that* POPULAR AVIATION *did not hear of this episode in time to do something.*

Flyer Blown Across Border

ON A trip from March Field, Riverside, Calif., to Lordsburg, N. M., Lieut. James Roberts had a most unusual experience. South of Tucson he ran into a desert electrical storm accompanied by a heavy wind. For some time he held a steady course but the gasoline supply began to run low and he attempted to fly round the storm and headed with the wind.

Traveling in a single-seater Pursuit, which travels rapidly when carried along by a strong wind, the Army man was far over the Mexican border before he hardly realized his situation. The country was very rough, covered with mesquite brush, and he had to search some time before he saw a likely landing. Then it was in a rancher's yard, miles from anything that looked like a town.

Imagine the surprise of the illiterate Mexican rancher when he stepped out in the yard and saw this huge bird settling in his yard. By this time it was raining so hard that the flyer was forced to wait forty-five minutes before he could leave his plane and make his way to the little adobe shack.

He tried to obtain some means of getting to the border so that he might notify his command his whereabouts, but was unable to do so because of the heavy floods that had followed the downpour. The next morning he hired a horse and rode to the nearest town, secured 10 gallons of gasoline which he sent out by truck. After having cleared off a suitable runway, and mending his wings which had been somewhat damaged on the mesquite, he took off once more.

In the meantime the field had sent out several ships to look for the lost flyer. A radio message reached them while in the air that Lieut. Roberts had landed safely at Palo Alto, Ariz.

Old Boys Now Organized

THEY were young fellows, but the Over-Fifty club up in New England figured their ability probably would improve with age, so they were voted into the club.

The recruits, who recently won their private flying licenses, are Arthur L. Johnson, 52, a Providence, R. I. wholesale grocer, and Frank T. Coffyn, 51, of Boston, who several times went into the air with Wilbur Wright back in the days of aviation's infancy.

The club, which limits its membership to men over 50 years of age who have flown solo, has half a dozen members whose ages are nearer 70 than 50. E. W. Higgins of the Rhode Island State airport at Hillsgrove founded the club.

An Aerial Seeding Job

A forest fire burned 2,000 acres of the Santa Barbara National forest, but, thanks to the airplane, the area was seeded with clover in two days, and saved from excessive rain wash.

Byrd's Protege is Lucky

BELIEVING that American aviation's rapid development depends largely on the youth of the country, Admiral Richard E. Byrd announced from his headquarters that he will take Arthur Abele, Jr., 22 year old aviation student and enthusiast on the second Antarctic Expedition as a representative of the millions of young people in this country.

Abele is forming an organization called the "Little America Explorer's and Aviation Club" and is inviting everyone of high school age or over to become a part of the Expedition by following the progress of exploration on charts or maps to be furnished by the Tide Water Oil Company. He expects to send back a weekly news letter to club members giving not only details of the adventure but also pertinent information on aviation at the South Pole.

Admiral Byrd has arranged for Abele to take a complete course in aviation, including flying lessons and business training in the transportation possibilities of aviation, during his stay at the bottom of the world. His ground work and flying instruction will be given under the most dangerous and hazardous conditions ever to confront a rookie flyer. Abele has never flown a ship, in fact has been in the air for less than thirty minutes, but expects to become an expert pilot before the Expedition returns from the Antarctic wastes.

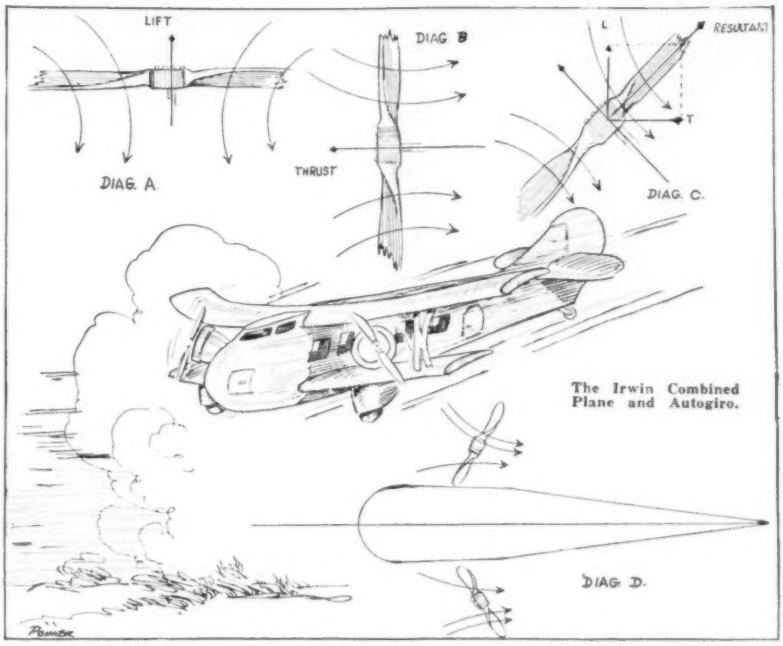
A slight, straight young man with frank blue eyes, a shock of blond hair and a serious mouth, which without warning breaks into a friendly infectious grin, Abele was graduated from Harvard last spring—without the accent, he would have you know.

Inheriting a taste for adventure from a sea-faring, pioneering Connecticut family, Arthur has crammed much excitement into his 22 years—all the way from scrubbing decks on a West Indies tanker to surveying forests in the vast woods of Michigan.

Arthur worked his way through school yet maintained a high average in his studies. He shipped on tankers and freighters "chipping paint, scrubbing decks and raising blisters," worked for the United States General Land Office surveying the forests of Michigan and one summer did duty as a bellhop in a fashionable New York resort hotel.

Arthur's father, Captain Arthur Abele, U. S. N., retired, is now stationed in the Boston Navy Yard in charge of the Massachusetts Nautical School Ship, the U. S. S. Nantucket, and is delighted that Arthur is sailing under Admiral Byrd, who was Capt. Abele's classmate at Annapolis years ago.

Irwin's Combined Airplane and Autogiro



The Irwin Combined Plane and Autogiro.

HERBERT E. IRWIN, Barons, Alberta, Canada, has invented and patented a highly interesting aircraft which combines the functions of an airplane and Autogiro. The lift of the biplane wing structure is assisted by swiveled propellers at low-speeds, take-off or landing.

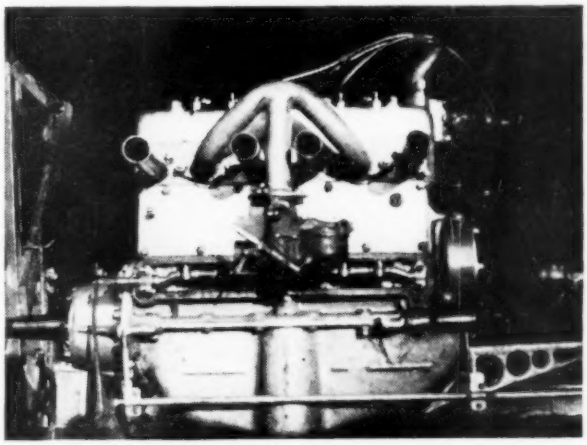
With the blades in a horizontal plane, Diag. A, the propeller is exerting its maximum lift. When in a vertical plane, Diag. B, the full thrust of the propeller is exerted in driving the ship forward. And when inclined to the horizontal, the prop gives combined propulsion (T) and lift (L) as in Diag. C. Thus, any reasonable compromise can be made between lift and thrust.

Diag. D is a plan view showing how the propellers converge the airstream to the rear thus avoiding blind spots and conflicting wake-streams. The convergence is slight.

Granath Supes-Up the Ford "A"

AFTER several years of experimenting, Mr. Granath, Chicago, Ill., has perfected his variable compression device by which a gasoline engine can be made to develop a maximum horsepower with a minimum of displacement and weight. At present, this system is applied to a Model "A" Ford engine, and the "A" swings a prop designed for an OX-5 engine (90 h.p.) at a higher speed than the OX-5.

The compression is varied by means of wedge-shaped cam followers that can be moved back and forth between the cams and tappets. When running at low speed, the low-compression adjustment is used, and at "top" with the high compression adjustment.



Side elevation of the Ford "A" engine as improved by Mr. Granath.

The Bleriot Monoplane "Joseph Le Brix"

The Bleriot monoplane "Joseph LeBrix" just before its long non-stop flight.

THE Bleriot monoplane, "Joseph Le Brix," recently made a long non-stop flight from Floyd Bennett Field, N. Y., to Persia. It was flown by the French pilots Maurice Rossi and Paul Codos with the daring intent to keep on flying until the gas gave out. According to their estimates, the fuel should have carried them to Narachi, India, a distance of 7,200 miles, but the actual flight was considerably shorter than this, approximately 5,000 miles from the starting point.

This top wing Bleriot plane differs from most of this type since the wings are externally supported by stay-wires and are not of the full cantilever type. Two sets of stays run from the central cabane to points halfway out on the front and rear spars.

An Airport Built for $110.00 in the South

ONE never knows what chance remark may revolutionize the order of things or make a practically unknown little hamlet almost famous overnight.

Such is what happened to the Town of Wewahitchka on Dead Lakes, Gulf County, Florida, one day when a party of fishermen were at Idlewood Fishing Lodge. In the party was a pilot from Pennsylvania who remarked that if they had a landing field at Wewahitchka, he and some friends could fly down from Pennsylvania each week or so, whereas driving down—there is no railroad at Wewahitchka—took too much time from business.

One of the owners told the aviator that they would have the emergency landing field constructed right away and that is exactly what was done.

Going to the county commissioners of Gulf County, they donated the land, providing the county would do the work. Inasmuch as this would serve a three-fold purpose, the commissioners agreed to construct the landing field with county funds.

However, in order to give everyone in Wewahitchka a chance to "bid" on the landing field, so to speak, they inspected several sites offered by various citizens of the town. The site finally selected was land owned by Idlewood Fishing Lodge, because it would require the least amount of work in addition to being absolutely level ground.

The field is in the shape of a T-square, being 300 x 600 x 1100 feet and is less than three hundred feet from the back door of the Lodge. The total cost of construction was $111.00 and as an emergency landing field it is one of the best in the United States regardless of cost.

Besides relieving destitution among the "jobless," the construction of the emergency landing field also stimulated the aviation industry as well as advertising the community in which it is located.

Idlewood Landing Field, as it is known, is five miles due north of We-

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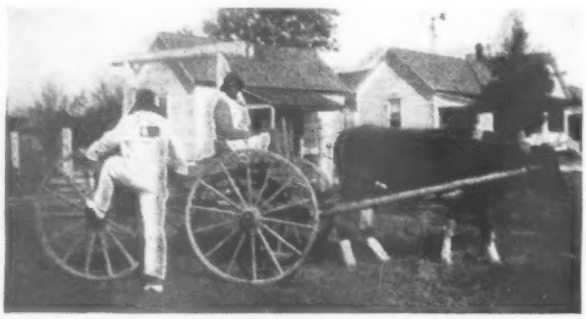


At Wewahitchka, Fla., there are strange contracts in transportation as this primitive ox-cart shows.

The Boeing XP-936

(*See Drawing on opposite page*)

ON THE opposite page will be found scale drawings for the Boeing experimental pursuit plane known as the XP-936, which has been superseded by the Boeing P-26-A.

The P-26-A, which is essentially the same ship, as the XP-936, except for minor refinements, is said to be the fastest plane in the service of the U. S. Army Air Corps, if not in the world. It is a low-wing monoplane with its wings externally braced while the landing gear is of the wire-braced type.

Owing to the rules of the U. S. Army Air Corps, we are not permitted to print the scale drawings of the P-26-A shown on the cover of this issue, but to satisfy the demands of our model builders we are showing the XP-936 which is close enough for their purpose. The new models are now in production at the plant of the Boeing Airplane Company, Seattle, Wash., and a number will soon be delivered for actual service.

The front view will show a dihedral angle of 4° which is quite high for Army ships in this country, although this is quite common in Great Britain. This is permitted by the use of a fixed center section in the fuselage and the two outer wing sections connected to this section.

A Tale Fit for the Liar's Club

IF SOMEONE were to attempt a yarn about a pilot who went into a spin close to the ground, actually hit, only to bounce into the air once more and to continue flying; he would probably be violently ejected from the more select circles of flying men. But, believe it or not, it actually happened to Lieutenant L. E. Hunting of Uncle Sam's flying corps.

Lieutenant Hunting went into a spin close to the ground. Evidently it was a flat spin; because after smacking terra firma, the plane bounced into the air and continued on its way. The landing gear was smashed, but the pilot landed at Kelly Field without even turning over. This occurred in 1927.

Some People Fly With a Horse-Shoe

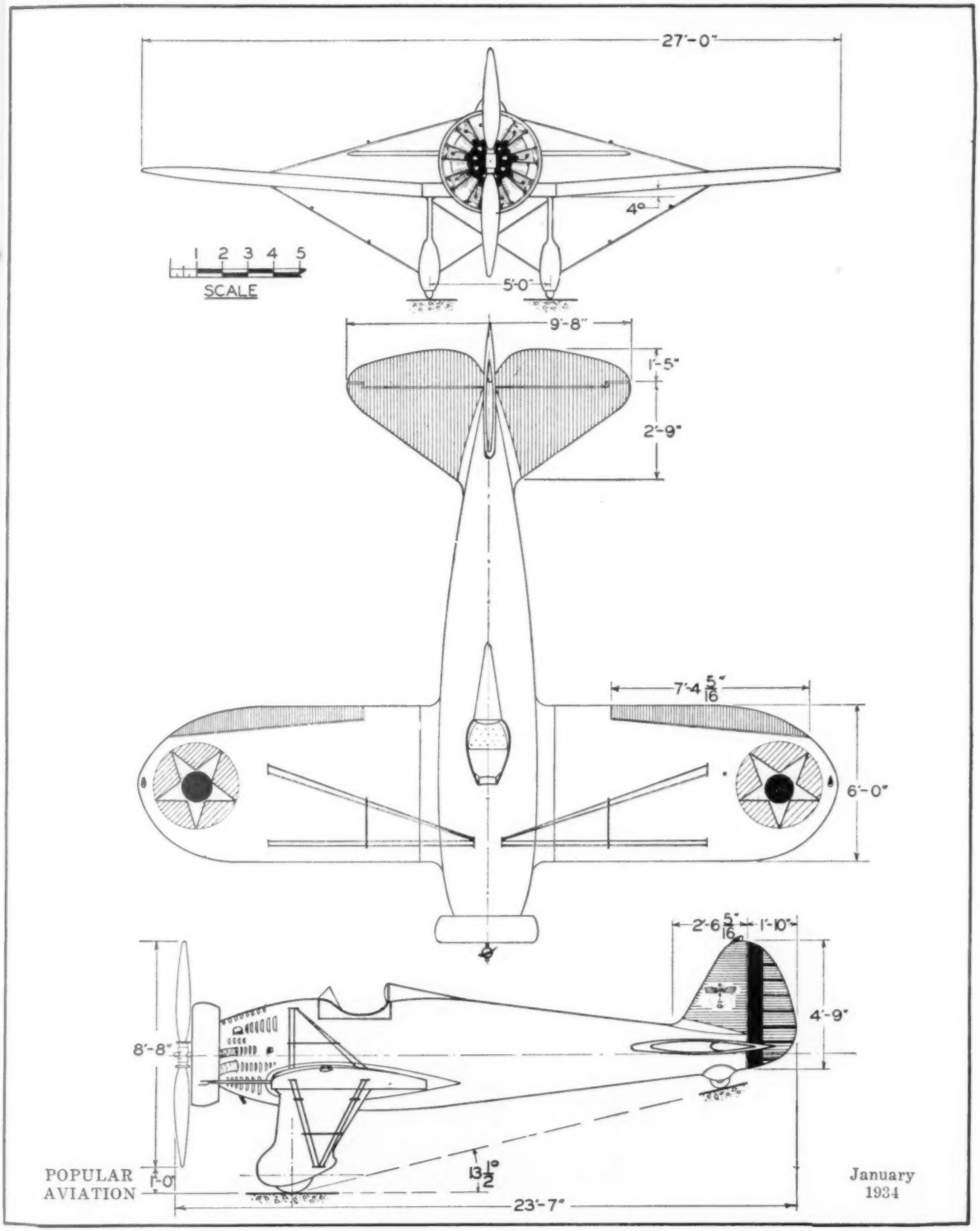
LIEUTENANT WALTER C. WHITE, U. S. Army Air Corps, must have made sacrifice offerings to the Goddess of Chance one afternoon back in 1925 or perhaps he carried a rabbit's foot. Nevertheless he walked away from what might have been fatal under ordinary circumstances.

Flying a Sperry Messenger at 1000 feet over Mitchell Field, Lieutenant White became bored and decided to do some barrel rolls. Imagine his embarrassment when his plane went into a spin and crashed before he could do anything about it. But imagine his surprise when he crawled from the wreckage to find nothing worse than a broken ankle.

Scale Drawing of the Boeing XP-936

(*See Opposite Page*)

This experimental plane of the U. S. Army Air Corps has been superseded by the Boeing P-26-A, but with the exception of a few minor details the two models are essentially the same.



Rex — The Human Glider

by RETTA E. EWERS

What do you think of this?

ALTHOUGH he is only twenty-three years of age, Rex Finney, Riverside, California, is entitled to the title of "veteran parachute jumper." Rex began his jumping career while working for the Russel Parachute company in San Diego.

"The desire to try out one of the things became too great," Rex said, smilingly. "It got to be a fever so I just had to try it for myself."

He has taken part in practically every air show of importance that has been held in the southwest. Perhaps the most spectacular stunt staged by Finney is when he turns himself into a human glider.

"A triangular piece of sailcloth fastened between the legs of my coveralls, does the trick," he explained, "and as I speed earthward I spread my legs wide apart, the wind catches the sail and I shoot skyward once more in a zooming stall. When I flex my knees and arch my back, I can almost manage my descent as well as if I had a plane under me. Once I actually did a loop, very apparent to those below."

The practibility of such an arrangement is that a naturally top-heavy parachute jumper may right himself and be able to some extent to steer his own course. On one occasion, the wind was so strong that it split the canvas sail, forcing Finney to pull the rip-cord much sooner than he had planned.

Night jumping is done by Finney and to aid those watching below, he carries flares with him to light up the inverted bowl of the parachute.

Oh boy! Just what if—? One spark —silk fabric—flash—flowers! Tears!

But Finney is very optimistic and cheerful. His record for fast jumps is five parachute drops in the time of two hours, and 54 seconds. Between each jump he repacked his own chute. During the 1933 air show at Los Angeles he made nine jumps, bringing his grand total to 120 jumps all told. Not so bad for a start, do you think? Perhaps a second "Spud" Manning. And a living reminder of that gallant and brave jumper who is no longer with us.

Canfield Combines Business With Pleasure

by GEORGE M. PAUL

OUT in the Dakotas are being demonstrated several novel ways in which airplanes can be used to decided advantage. E. M. Canfield of Williston, North Dakota, has carried game wardens over the brush lands to spot illicit deer hunters, with such good luck that as soon as an illegal deer is killed, it is quickly covered with brush so that it cannot be discovered from the air.

He has also taken Federal Prohibition officers over the brush country of the Missouri River bottoms to spot moonshine stills. On a clear day a wide area is visible from a plane flying at an elevation of 500 to 1,000 feet, with the result that the eyes of the law see far and wide.

The Dakotas have their full share of coyotes. These foxy pests of the plains are as fleet as the wind and know every hiding place in the township, but they can be shot from the air, though this feat calls for steady nerves and a quick finger on the trigger. On the coyote hunts, Mrs. Canfield usually goes with her husband and takes the controls for the dangerous "hedge-hopping"—the long swoops that bring the plane close to the ground in order that the marksman can make sure of his moving target.

When a coyote first sees a plane, he doesn't show any signs of getting excited, but when he suddenly realizes that the plane is headed straight down in his direction, then he leaps into action and cuts through the air with his own propellers. He makes for the underbrush or the tall grass, and if he reaches his place of refuge in safety, he can well thank his lucky stars that his first lesson in aviation has been a harmless one.

Most of the shooting must be done from very low altitudes—from 50 to 60 feet. This means that the plane must be held in perfect control, for if it should hit an adverse air current or lose forward speed, a disastrous plunge to earth might follow, and the hunt would be all off.

It is easy to detect illicitly killed deer and moose from an airplane and to bring the malefacors to judgment.

On one hunting trip Mrs. Canfield was forced to think quickly and to land speedily. A shot went wild and zipped its way into the whirling propeller. Mrs. Canfield brought the plane safely to the ground, and then they made an inspection of the damage. As is usually the case out on the vast prairies of North Dakota, they were miles from a settlement, but they made the best of a bad situation and Mrs. Canfield started in to prepare their supper while her husband taxed his ingenuity and skill to repair the damaged propeller. Nightfall found them still seventeen miles from Nowhere, so they spent the night with their plane and managed to fly back to Williston the following day.

Whenever Canfield kills a coyote, Mrs. Canfield swings the plane around so as to circle back over the spot. Then her husband drops a marker, a rod with a red flag attached to it, to mark the spot where the coyote is to be picked up. Killing coyotes affords not only sport, but also profit. There is a bounty in many states; $3 for each old coyote and $1.50 each for the pups. This spurs the hunters to redoubled efforts to track down these howlers of the plains that take such a toll of calves and lambs in the course of a single season.

A Russian Quadrumotor Transport Plane

RUSSIAN engineering genius has produced a high-winged transport monoplane with four engines faired into the wings. At first glance this ship somewhat resembles the Ford Trimotor except the landing gear. This ship is used on the long trans-Siberian runs where reliability is paramount.

The Russian Four Motored Transport Plane. —Soyusphoto.

Guessing at Airship Structures

by I. OESTERBLOM, C. E.

In this article, the author tells just how little engineers know about stress calculations and computations relative to the strength of airship structures. This highly technical matter is written in a very simple fashion so that all may understand it. You will be appalled at his findings.

ABOUT one generation ago, those who were then young and also old enough to understand, stood in wonderment at the airships. A few years later we stood in equal—if not greater—wonderment before the airplane. The airship seemed to be safer of the two at that time because it could at least stand at ease in the skies with the machinery at rest.

But the Science of Aerodynamics has, in the meantime, made very rapid progress and so has the art of producing airplanes. Can we say that the art of producing airships has likewise advanced? If one may judge from the many airship accidents, it has not been accomplished, and therefore, the history of airship design will bear a little closer study before we decide whether airships should be still further encouraged or ruled out entirely from our system of transportation.

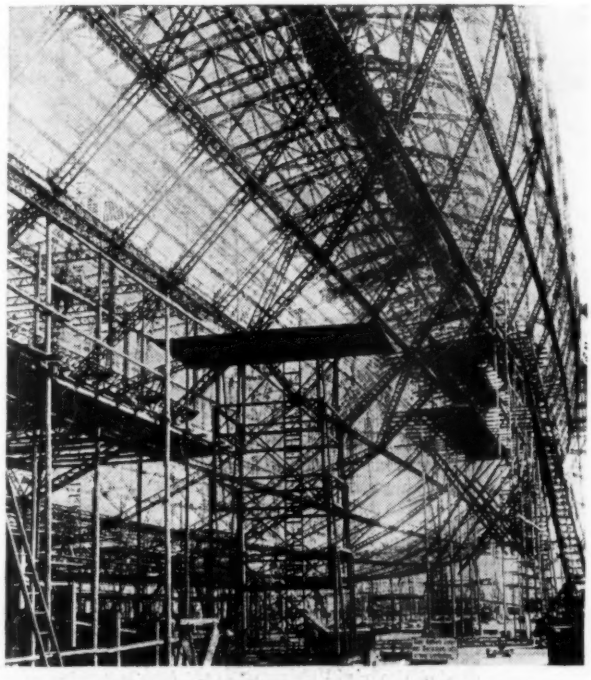
Unfortunately, a great deal of the history is hidden away in private records and is therefore not available to the public, which has to take the chance of riding in the ships.

Count Zeppelin, as an officer in the Federal Army in the United States during the Civil War, had learned the art of ballooning, and later on, when retiring as an officer from the German Army, decided to renew his old hobby and go one step further by building airships. He had the general idea how it should be done; a series of balloons in a row, held together in a light frame with the engines and propellers suspended therefrom. There were to be passenger and control cabins also suspended and rudders for steering.

The idea seemed to be sound, yet the first ship failed on its trial trip in 1900. It crashed in landing. The third ship, in 1906, was a fair success, for it attained a maximum speed of 30 miles an hour. Afterwards, many ships were built, first very small but soon of larger dimensions. The first ships had wooden frames; but later models had aluminum frames, which through Hall's new process of aluminum production in the United States, had become very cheap. The metal frame added to safety, because it served as a "Faraday Cage" to exclude the electric charges from the interior and thus made the enclosed gas safe from lightning and static sparks.

Later, through the development of the airplane, gasoline engines became very powerful, efficient and of light weight. The early Zeppelins had to carry a heavy engine dead-weight, including much fuel and the payload capacity was correspondingly small. This was compensated for by making the aluminum frame sections the smallest possible. Later on—during The Great War—the Zeppelins were also called upon to carry explosives for destructive raids on enemy cities; and this was a further reason for keeping very slender structural sections.

Up to this time, there had been no need for heavy construction—one travelled slowly and navigated cautiously, one did not tempt Fate when the weather was unfavorable. Airship travel was, therefore, an easy floating in the skies with the propellers gently urging the ship in a given direction. There was no hogging and sagging, pitching and yawing. There were no squalls to meet, no high speeds and at no time—heavy bending of the frame.



A closeup view of the latest giant rigid airship now under construction, showing the maze of structural members, many of which are indeterminate and cannot be computed directly.

We have good reason to believe that the early frames were designed by mere guesswork; from gathered experience and observations, then corrections and adjustments were made whenever needed.

In the meantime they developed airmanship, both the commanders and the crew. The commanders were tutored in what little was known of a scientific nature, and they were thus prepared to think quickly and act with precision in an emergency.

That the Germans knew very little of design was made clear enough to the British during and after the war. In the matter of airships, the Allies had been taken by surprise. They had watched the early Zeppelins with curiosity but never seriously. But, naturally, they expected the Germans to know a great deal about airships and wanted to find what they knew.

The L33 was brought down intact and the Allies found extensive notes concerning air navigation on the dead commander of the wrecked ship.

Then they set to work to copy the ship and to study the notes. There was nothing on the matter of design—they could develop no new types or sizes, hence they had to be satisfied with mere imitation. When the war ended, the Germans had to confess that they had no rational method of designing the airship hulls and had been forced to use empirical rules. Lt. Col. W. Lockwood Marsh makes this clear in the 1930 "Air Annual of the British Empire."

After the German L33 came the British rigid ships, the R33 and R34, also—with modifications — the Shenandoah. Was it lack of American airmanship or error in the improvements which brought this great ship to its disastrous end? The British and the Americans at that time co-operated closely, each telling the other whatever he knew. Even after the war there was co-operation.

Commander J. C. Hunsaker, American, designer of the Shenandoah and Honorary Fellow of the Royal Aeronautic Society, won the R38 Memorial Award of Great Britain in 1923 for the best paper on airship design. His co-

authors were C. P. Burgess and S. Truscott, government officials in Washington. The paper was submitted to the Society, with its wealth of intimate detail, by the permission of Admiral W. A. Moffet, Chief of the Bureau of Aeronautics.

Not only in Washington had one felt that the German empirical method of airship design was unsatisfactory—the same judgment had prevailed in London. After the failure of the L38, in August, 1921, the British appointed "The Airship Stressing Panel" to study rational methods of design. On this Panel were several distinguished Britishers: R. V. Southwell, F. R. S., etc., and brilliant mathematician, Dr. A. J. Sutton Jippard and Major G. H. Scott—also one American: C. P. Burgess, Naval Constructor, in Washington.

The Panel had a tremendous task ahead and was requested to report quickly. It did so in August, 1922. Mr. Southwell has told us the story of the work of the Panel and the difficulties they encountered, both in the official Reports and Memoranda of the Royal Airship Research Committee and in the Journal of the Royal Aeronautic Society.

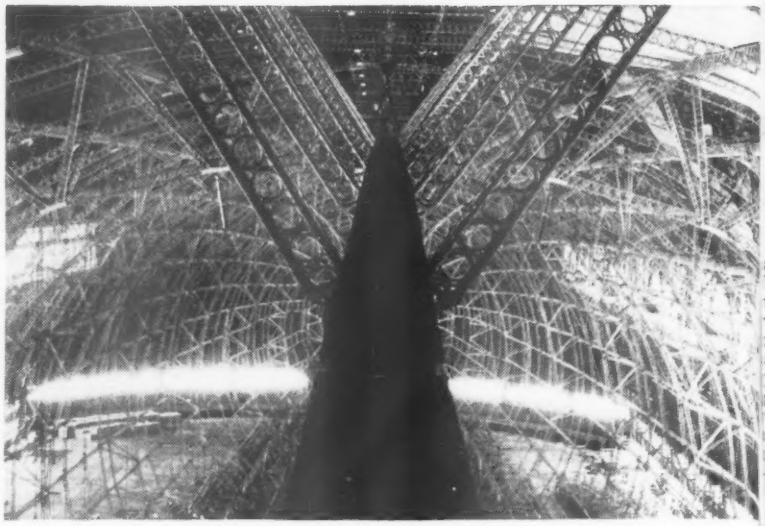
From all these papers, we have the unanimous opinion that a purely empirical design is unsatisfactory, also that a completely rational design is quite impossible—and this on account of the extent of the mathematical complications. Let us, therefore, give some attention to these complications and to the semi-rational methods on the basis of which more recent airships have been designed.

* * *

AN AIRSHIP frame, in a structural sense, is quite different from any compound structures we ordinarly have to deal with. Beams, columns, skyscraper skeletons, bridges—they are all resting on real and substantial supports and are subject to stress through the actions set up between the external forces and the reactions in these supports.

In the airship, we are dealing with a giant framework floating in space, supported by balloons, pushed by engines, carrying loads, and subject to translation with the winds—a different problem. The framework is substantially ellipsoidal in shape: it has several series of longitudinals from bow to stern, also a succession of transverse rigid frames, (usually built as circular trusses) and diagonals or shear wires between the two sets of elements.

At each nodal point, therefore, where the three sets of elements intersect, there must be not less than eight elements coming together. In a modern airship having a number of both longitudinals and frames—the reader is referred to photographs—there are consequently more than three hundred nodal points and also, unfortunately, more than one hundred redundant members. The meaning of the "redundants" must be reviewed, for in these members rests the curse of unavoidable ignorance.



The interior of the Akron's hull in which the black streak is the "cat-walk" or runway.

The frame is what the engineers call an "indeterminate structure." It takes only three members definitely to establish a point, as the tripod so well illustrates. Anything having more than three points, therefore, is a superdetermination and introduces the elastic relations between the members. Most of the apparently superfluous members are redundant members and in them act the redundant forces, generally difficult to find. It is so because their discovery involves the complicated relationship between internal energy elements and deflections, all of which and for all parts of the frame, must be considered simultaneously.

Sufficiently broad to be applicable to the airship frame, there is known only one method to find the redundants, namely the method of Castigliano. This is based on the internal strain-energy equation for the frame as a whole (all elements summarized), which partially differentiated in reference to each redundant, gives one equation for each in a simultaneous system with as many unknowns—scattered all over these equations—as there are redundants.

Theoretically, this system is soluble through determinants or gaussian algorithms, but practically it is not. There is excessive labor to solve so large a system—one hundred equations, more or less—and there is also excessive error through the progressive multiplication beyond reason of the original errors of approximation in the known elements. The answers for the redundants would therefore be quite worthless. In practice one seldom attempts more than ten to fifteen equations.

This difficulty had equally confronted the American and the British investigators; it had undoubtedly confronted also the Germans, who had remained contented, however, to continue on an empirical basis. Possibly it had risen before the French also, who have discarded the rigid ships entirely and the Italians, who have carried on their developments—consistently and very successfully—with blimps and semi-rigid only.

Great Britain and the United States co-operating closely, developed the idea of an approximate rationalism; to treat the longitudinal elements and the diagonals as one system and each transverse frame as a structure apart—all however, with rationalised modification pertaining to the interaction of the parts, if this should be found necessary. We are thus coming down to method and phraseology better understood by the old-time engineers.

Before we pass on to a review of the semi-rational solution it is in order to point out that the facts here noted are fully admitted by the authorities in the papers referred to, and this has reference both to the unsurmountable difficulties and the doubtful solution. From Germany there seems to be no published authoritative information and presumably none to be made.

On the longitudinal elements the deadloads and the supporting bags—and for that matter also passengers and crew—have very little effect, and this because one arranges for a fair distribution of both the loads and the supports. Quite the reverse is true for the aerodynamic forces, whether these be due to pitching, yawing, circling or squalls of wind. All of these have bending effects more or less severe.

For any group of longitudinal elements, therefore, one assumes a transverse section and that the elements there are stationary and rigid, and then figures the bending moments for the wind forces acting on either side. All of these are truly direct acting; one may consider, if one so prefers, that those on the rudders and elevators are reactionary.

For any unbalanced effects of the gravitational loads one must also figure the moments at the section. For the material available in the section we then figure the moment of inertia and

(*Continued on page* 50)

Letters from Our Readers

Letters on all sorts of interesting subjects are received daily at the office of POPULAR AVIATION. A few of these letters will be presented each month on this page.

"WHENEVER I hear about home-built planes, I get a sudden ambition and then cool down again. In the course of my life I have built three good lightplanes, one of them being quite a speedy affair with which I won some money at local air-meets. I sure would like to start in again, for I feel the urge of the cow-pastures, but these dinged state laws get me all jittery and wet blanket the whole idea. If the jails were cleaner and more comfortable around this territory it would be a different matter." —Joe-Joe Fredericks, Cleveland, Ohio.

(Why don't you have them fix a special cell for you?)

* * *

"First, I want to congratulate you on the excellent features in P. A. Next, I have an error that I wish to point out to Jack Knoble. The insignia on the Savoia-Marchetti boats are red, white and green—not blue.

"How about some full page pictures of foreign ships? I am building these miniature planes and I would like pictures of foreign planes like the Marchetti boats."—Ray Cheeseman, 4704 Kewanee Ave., Chicago, Ill.

* * *

"I read the article "Hang 'em on the Wires—Peelot," in the October issue of P. A. and enjoyed it very much. An accident of this sort happened in Dallas a few weeks ago to a Curtiss-Wright Junior that landed on some high-tension wires."—Lloyd Graham, 502 E. Ferguson St., Tyler, Texas.

* * *

"I have just begun work on a biographical novel to be entitled, 'Log of the War Eagles.' But, Mr. Editor, I'm sure having to do a lot of research work to verify my facts and figures and would appreciate any suggestions as to the sources of information that you may have to offer.

"Also, kindly do me the favor of mentioning that I will pay for any records from readers that I can use. Tell them that I will send a free copy to every man furnishing me with facts and photographs that may be found available."—William L. Hopson, Box 314, Oro Grande, California.

(Oh, boy, you're due to get into contact with all of the prevaricators who have survived the world's worst. Plenty of 'em have reported to this office—and we know.—Ed.)

* * *

"I am enclosing a photograph of the "Power Barrel" engine which is of novel design. As you see, the cylinders are arranged around the crankshaft and parallel to the shaft. This gives a desirable small diameter. What do you think of it from a practical standpoint?"—J. P. Dolard, 10-266 General Motors Building, Detroit, Mich.

(This is not new, in fact there were about a dozen of this type tested during the war. They were then called "Wabblers" and none of them proved satisfactory because of the small flywheelage, limited cooling air velocity and difficulties with the cranks or substitutes for cranks.—Ed.)

* * *

"You big bozo, clear that field! Can't you see that I'm going to sit my sky buggy down on your field. If you don't clear the field, I'll swoop on you and riddle your hangars with tracers. How you like that, huh?

"Well, now that you've cleared the field, I'll drop in and give you my opinion of P. A. It's the best darn aviation magazine in the market, barring none.

"About that mystery ship that caused all those discussions. No, it isn't a Jenny and I wouldn't call it a Canuck either. It has a Jenny radiator and engine, but the fuselage, wings, landing gear and rudder are of the Standard J-1. I've flown dozens of Jennies, Canucks and Standards, that's why I know.

"I am in the army if that doesn't mean anything, and I've owned a Jenny and a Swallow. Alexander Beatty of Rochester, N. Y., is on my side and that bird knows his races. So, I venture the statement that I don't see why racing and stunting should keep other people from flying. They don't have to stunt just because we do.

"The 'dinky's' are good and should wake up some of these wouldbe poets (It has waked up about a million of them—Ed.) P. A. is always good and I've been a steady P. A. fan for four years. Don't quit publishing it or the fleet of us war birds will be down on your tail. Yours 'til I crack through to China."—Pilot Stanley Walker, Fort Snelling, Minn.

Our old friend, Archibald, has become so accustomed to home-study courses that he is, seriously, applying the same idea to his first jump.

* * *

"The Barter and Exchange section in 'Pop Av,' is just about the berries and reflects the spirit of helpfulness that you have always extended toward your readers. I have made three good trades, trading articles for which I had no further use (and good ones) for items that I desired but did not have enough money to purchase."—Joseph L. Britton, Rochester, N. Y.

* * *

"I am certainly enthused over the new data sheets, but wish to put in my two cents regarding their arrangement. I wish that you would print them with the reverse side of the page blank so that I would not destroy the reading matter on the other page. As a matter of fact, they should be on an insert, independent of the rest of the book."—James K. Waller, Fresno, California.

* * *

"Some months ago, I forget in which issue, one of the writers in P. A. told about making money with a plane by taking aerial photographs. This is a fine idea, and I know a number of the boys who made good along this line, but I have gone them all one better by my method of taking "aerial photographs." I put my plane out on the field in a prominent place on Saturdays and Sundays, and get my customers to sit in the plane while I take their pictures.

"I put a helmet and goggles on them, and a stranger would never know whether they were just dubs (as they are) or real pilots. There are a lot of four-flushers who will show these shots to their friends and I am cleaning up a lot of jack by this weakness of the human race. Just tell this to the rest of the boys, for it don't cost much to get in the game. All I have is a $3.50 box camera and I get 75 cents per shot."—Bill Vere, Farmingdale, L. I.

* * *

"I got bawled out good and plenty for riding the beacon on the . . . airways, by one of their officials. And I was not only bawled out but threatened with a severe slap on the wrist if I did it again. Now, if these beacons are installed and operated at government expense, I think I have just as much right to ride the beam as anyone else. What do you think?"—J. Abelson, Denver, Colo.

(I think the same and suggest that you stand up for your rights.—Ed.)

A Friend of Aviation

LaGuardia as a pilot.

MAYOR ELECT, Fiorella H. LaGuardia, New York City, has always been intensely interested in aviation and has always acted in behalf of aviation in his official capacity while in Washington.

We show him here in his plane, goggles and everything, already for a take-off. While many executives have been interested in aviation from an academic point of view only, LaGuardia goes them one better by sitting in the pilot's seat and flying the ship in fact.

LaGuardia is the friend of the Civilian Air Corps reserve plan and was of assistance to POPULAR AVIATION during our drive for this idea.

Results of Cover Error Contest and Winners

AND was the cover error contest a wow? We'll say so, for there were 177 entries altogether, including letters, telegrams and telephone calls. And we had all kinds of comments on every part of the Aeronca shown on the cover of the October issue, until we were fairly flabbergasted. We wish to introduce the winners of this contest—the ten lucky ones who get a year's subscription to P. A. free.

Chas. F. Johns, Sackville, N. B., Canada.

James Hughlett, 620 Cherry St., Bristol, Va.

Geo. Floyd, Jr., 41 Proctor Place, Toledo, Ohio.

J. I. Boyd, Conway, Mo.

Miles A. Snyder, 1012 S. Oak St., Champaign, Ill.

Oscar Schaffner, 205 Nichols St., Clearfield, Pa.

E. Fredrickson, 2425 W. Lewis St., Blue Island, Ill.

Kenneth Hawk, 870 Exeter Ave., West Pittston, Pa.

Howard G. Hemming, 70 Anita St., New Haven, Conn.

Emil Snyder, Nauvo, Ill.

And this is the error to which 84 readers called our attention—the "N" on the tail is reversed, that is, the cross mark of the "N" slants in the wrong direction.

In regard to the omission of the license number or identification numbers on the wings, to which many of our readers pointed, we have made this omission purposely many times where the numbers would be likely to obscure some important detail on the wings—and besides, these numbers spoil the picture. On this point, our readers were half right and half wrong.

Four or five men remarked that there was no rudder, but the dividing line of the rudder is plainly shown on every copy we have seen. Others remarked that the ship sails in a horizontal position around the pylons, but it is almost universal practice to nose the ship down on the turn to avoid losing speed.

Others criticised the landing gear struts, but these are O.K. on the model shown. Others claimed that the pilot could not control the ship on the right hand side (where he is shown sitting) but this can be done easily and it would be very likely that he would be in this position on a turn. He can reach the stick from any point.

Still others commented on the fact that the aileron flaps are in neutral, and that the inner or outer flaps should be depressed. This is a debatable matter, for near the completion of the turn, as shown, it is very likely that the ailerons would be in neutral.

GLOSSARY OF WORDS, TERMS AND PHRASES — DIC-A-3

Adjustable Pitch (Propeller). See Adjustable Propeller.

Adjustable Struts. Struts or compression members provided with adjustments for length.

Adjustable Wings. Wings provided with means for adjusting their area. Preferred term:—Variable Area Wings.

Advance. (1) To move ahead. (2) To cause an event in the cycle of a machine to occur earlier.

Advanced Spark. An ignition spark, in a gasoline engine, that occurs before the piston has reached the end of the compression stroke.

Advanced Timing. Adjusting the mechanism so that the events occur earlier than normal. Thus, the valves of an engine may be advanced so that they open earlier.

Advancing Edge. Edge of wing entering air. Leading edge.

Advantage (Mechanical). The gain of lifting effect or force created by leverage or other mechanical multiplying linkages, pulleys or gearing. If lifting effect is doubled, the mechanical advantage is 2.00.

A. E. A. (Abbr.) Aerial Experiment Association.

Aerial. (1) Composed of air. (2) Pertaining to the air. (3) A conductor arranged for the interception and reception of radio waves. Also known as an ANTENNA.

Aerial Experiment Association. An early and successful group of airplane experimenters (1907-1909) consisting of Alexander Graham Bell, Glenn H. Curtiss and Lieut. Selfridge. They produced the Silver Dart, the Red Wing, White Wing and June Bug airplanes.

Aerial Helix. The screw-type airplane propeller.

Aerie. (1) The lofty nest of an eagle or large bird. (2) An elevated habitation. (Also AERY).

Aeriferous. Conveying air.

Aeriform. Resembling air, gaseous.

Aero. Pertaining to air.

Aerobat. A flying machine, a dirigible or airplane.

GLOSSARY OF WORDS, TERMS AND PHRASES — DIC-A-4

Aerobatics. (1) Common usage—trick flying or aerial acrobatics. (2) The construction of airships, or AEROBATS.

Aeroclinoscope. A weather signal with arms raising or lowering with barometric pressure, at the same time showing the direction of the wind and low pressure area.

Aerocondenser. An air-cooled condenser for condensing steam engine exhaust.

Aerocurve. (1) A cambered lifting surface or AEROFOIL. (2) The outline or boundary surfaces of a section taken through a wing.

Aerocyst. An air cell.

Aerodone. (1) A glider or soaring plane. (2) Any plane plane or heavier-than-air machine that flies without an engine.

Aerodonetic. Pertaining to AERODONES.

Aerodonetics. As defined by F. W. Lanchester; The study of gliding and soaring flight.

Aerodrome. (1) Gliding or soaring machine, particularly the tandem wing monoplane devised by S. P. Langley in 1896. (2) A power driven AERODONE or airplane. (3) A balloon shed or housing for an airship. (4) A flying field.

Aerodromics. Science of aerial flight by planes or gliders;

Aerodromometer. An instrument devised by Zwaardemaker for measuring the velocity of air or gas streams.

Aerodynamic. Pertaining to the energy and forces developed by gaseous fluids in motion. The forces developed by moving air or bodies passing through the air.

Aerodynamic Balance. A rotating arm carrying an AEROFOIL used for measuring the air pressure on the aerofoil. Used before the wind-tunnel. (2) Wind-tunnel balance.

Aerodynamic Coefficient. Numerical constants of bodies subjected to air-streams, determined by test, and employed in the computation of lift, drag or resistance. The lift coefficients are symbolized by (Ky) or (C_L) while the drag coefficients are indicated by (Kx) or (C_D).

Aerodynamic Forces. Forces created by flowing air.

A. V. Roe is a Pioneer Model Builder

by JOSEPH J. LUCAS

IT WILL be of interest to the younger generation of model airplane flyers to hear that Mr. A. V. Roe, pioneer and noted aircraft designer and manufacturer, designed, built and flew model airplanes over 26 years ago. Mr. Roe is the famous designer and builder of the Avro planes used during the World's War.

The Daily Mail of London, 1907, offered three prizes: $750.00 for 1st place, $375.00 for 2nd place and $125.00 3rd place at a model airplane contest held in the Aero Exhibition. For this contest, Mr. A. V. Roe brought out five models and all were rubber driven types. Four of the models were biplanes and the fifth one was the Langley type "Tandem" monoplane.

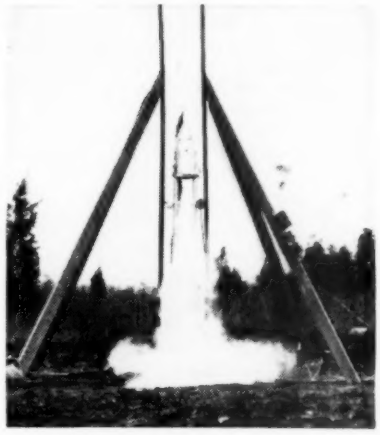
The models were entered for the competition and tested in flight at the Alexandra Palace on April 15, 1907. It is just twenty-seven years ago. This was the World's first model Competition. According to the rules, the judges were to take in consideration: "length of flight, practicability, stability, steering power (horizontal or vertical), speed, excellent design, excellent construction, method of commencing flight and available lifting power."

In the indoor test, Mr. Roe's No. 3 model covered the longest distance, a beautiful even flight of over 85 feet. Out of doors his model did not do so well and was placed only fourth with a flight of 50 feet. Nevertheless, he was awarded second prize of $375.00. The first prize was not given as the judges believed the award was not justified. Mr. Roe's prize winning model was a biplane with a wing span of 9 feet and chord of 15 inches with a 2 foot propeller behind. At each end of the top plane was an auxiliary balancing plane carried on outriggers, trailing behind the main planes. Can you imagine the size of that biplane and the large quantity of rubber to give it power enough to fly? Mr. Roe deserves great credit for making this model airplane fly.

Based upon his many subsequent model flights, Mr. Roe made many inventions upon the airplane which were incorporated in the long line of Avros that performed so successfully during the World War and afterwards. F. W. Lanchester, also an early English model builder, and chief engineer of the British Daimler Automobile Co., employed the models to build up his elaborate mathematical theory of flight.

Contemporary with the Roe model model flights were those of T. W. E. Clarke, an English model enthusiast who probably was the world's first model airplane supply dealer.

New Sky-Rocket Experiments



Starting a Liquid Air rocket.

MANY interesting rocket experiments have been carried out at the proving grounds of the American Interplanetary Association near Stockton, N. J., but recent experiments with liquid oxygen rockets have proved the most interesting of all.

While the oxygen rocket weighs only one pound, it developed more than 40 horsepower in the tests and it indicated that a possible altitude of ten miles would have been reached had the rocket been released from the chute.

WING SECTIONS COMPARED — WNG-T-60

PROPERTY	N.A.C.A. M-6	Clark "Y"	N.A.C.A. C-80	N.A.C.A. C-72	Gottingen 436
1. Max. Lift (CL)	1.405	1.560	1.154	1.622	1.576
2. Min. Drag (CD)	.0092	.0099	.0077	.0102	.0099
3. Max. Lift/Drag (L/D)	21.100	21.100	23.200	21.200	21.300
4. Max. Thickness (% chord)	12.06	11.72	8.69	11.73	11.08
5. Max. C. P. Movement	35.500	54.400	43.5	94.800	58.4000
	* * *				
6. Lift (CL) at Max. L/D	.357	.373	.390	.423	.343
7. L/D at Max. Lift (CL)	8.500	.860	.730	.840	.870
8. Lift (CL) at 0° Angle	.0037	.372	.081	.420	.342
9. Angle at Max. (CL)	20.5°	18.6°	16.4°	18.6°	18.6°
10. Angle at Max. L/D	4.1°	0.1°	4.2°	0.2°	0.1°
	* * *				
11. Thickness at 10% L. E.	8.95	10.02	7.08	10.03	9.03
12. Thickness at 20% L. E.	11.17	11.39	8.67	11.39	10.82
13. Thickness at 25% L. E.	11.72		8.58		
14. Thickness at 30% L. E.	12.01	11.70	8.54	11.73	11.08
15. Thickness at 40% L. E.	11.95	11.40	7.96	11.62	10.55
16. Thickness at 70% L. E.	8.06	7.35	4.21	8.27	6.60
	* * *				
17. C. P. (%) at 0°		41.5	43.5	43.5	42.00
18. C. P. (%) at 4.3°	24.4	34.8	28.6	35.2	34.20
19. C. P. (%) at 8.3°	24.8	31.3	27.4	32.5	31.40
20. C. P. (%) at 12.4°	24.6	30.1	26.8	30.8	30.01
21. C. P. (%) at 16.5°	25.1	29.3	29.2	30.3	30.3
22. C. P. (%) at 18.4°	25.1	29.7	32.8	30.5	30.8
	* * *				

In the above tabulation, CL is the absolute coefficient of lift, CD IS ABSOLUTE coefficient of drag, and all velocities are in terms of feet per second.

POPULAR AVIATION, 1934 WNG-T-60

VISIBILITY FACTORS — NAV-M-50

VISIBILITY, determined by condensation of atmospheric moisture, is the distance at which large objects can be barely seen. Smoke is also an important item. The following table of visibility was adopted by the International Commission for Air Navigation and is widely used.

INTERNATIONAL VISIBILITY SCALE

Visibility Scale	Grade	Limiting Distance
0	Dense fog (pea-soup)	55 yds. (165 ft.)
1	Very bad fog	220 yds. (660 ft.)
2	Bad	550 yds. (1650 ft.)
3	Very poor visibility	1100 yds. (3300 ft.)
4	Poor	1.25 mile
5	Indifferent visibility	2.50 miles
6	Fair visibility	6.25 miles
7	Good visibility	12.50 miles
8	Very good visibility	31.00 miles
9	Excellent visibility	Over 31.00 miles

CEILING is visibility taken in a vertical sense. It is the distance from the ground to the bottom of the clouds or fog bank, above which, the ground cannot be plainly seen, with distinctness. A "low ceiling" denotes low lying clouds attendant danger in making landings or low flying. A ceiling less than 500 feet is dangerous, is "poor" at 1,000 feet or "good" at least 3,000 feet.

ALTITUDE increases the range of vision with clear air. In the following table, the altitude (H) is in feet while the distance (D) is the number of miles to the apparent horizon or the range of vision.

(H)	(D)	(H)	(D)	(H)	(D)
0.582	1.00	25	6.61	500	29.58
1.000	1.31	50	9.35	1000	33.41
5.000	2.96	100	13.23	2000	59.20
10.000	4.18	200	18.75	5000	93.50

COLOR VISIBILITY. The most penetrating colors through mist and rain are the yellows and orange tints. Amber lights are most used for penetration. The blue end of the spectrum is quickly absorbed by water vapor.

POPULAR AVIATION, 1934 NAV-M-50

Radio From Gliders

GLIDER pilots, soaring near Elmira, N. Y., conducted the first two-way radio telephone conversation ever to be successfully completed between two gliders and between a glider and a ground station. This was made possible by the elimination of heavy batteries in a newly-constructed lightweight radio. The tests were carried out by Warren E. Eaton, president of the Soaring Society of America; Prof. R. E. Franklin of the University of Michigan, and H. M. McDowell, Rochester, N. Y.

Scenic Air Tours

RAILROADS with scenic routes long have cashed in through advertising the natural beauties along their ways, and now the air lines are following suit. Pilots of the Eastern Air Transport have been instructed to fly over the area of Washington's famous cherry trees when they come to bloom. From the air the 3,000 trees, the gift of the Mikado of Japan, make a fragrant sea of pink blossoms around the Tidal Basin.

Over Here, They Shoot Them

THE British government has always encouraged private flying, and now the amateur clubs are receiving aid more substantial than good wishes.

Subsidies will be granted during the next five years at the rate of $91.75 yearly for each club member who qualifies for a pilot's license and $36.70 for the renewal of a license. Total annual payments to each club will be restricted to $4,404, but grants in excess may be earned at half rates to a total maximum of $5,505. Sixteen light airplane clubs in England are eligible for the grants.

Puzzle Answers

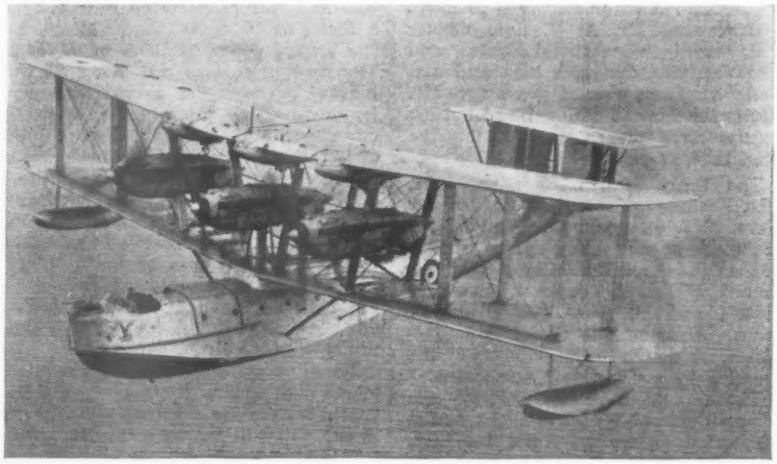
Below is the answer chart to the cross-word puzzle published in the December issue of POPULAR AVIATION. Because of the comparatively few words in the aviation "language," it is not possible to construct a large puzzle exclusively with aviation terms, but even at that, this puzzle has a fairly high percentage of air words.

G	O	N	D	O	L	A		E	A	R	H	A	R	T
I	N	D	U	C	T	I	O	N		A	T		A	H
R	E		A	E		R	I	G	I	D		F	I	R
D		F	L	A	P		L	I	V	I	D		N	U
E	R	A		N		B		N	E	A	R	S		S
R	E	N	T		F	I	R	E		L		T	A	T
	V		A	C	E		E		J		S	A	N	
P	O	P	V	L	A	R	A	V	I	A	T	I	O	N
	L	A	T	E	R	A	L		B	L	A	N	D	
H	U	N		A		D		S	E	A	L		E	D
A	T	T	E	N	T	I	O	N		S	L	Y		G
R	I	S	K		H	O		A	S	K		D	S	C
P	O		E	L	I		D	R	E	A	M		O	K
	N	A		O	R	I	O	L	E			S	A	E
I	S	L	A	N	D	S		S	K	Y	W	A	R	D

Here's your chance to find out whether you were right or wrong.

QUESTION AND ANSWER DEPARTMENT

All questions of general interest on any phase of aviation will be answered authoritatively by POPULAR AVIATION'S Technical Staff.



Many British land transports and flying boats have the engine nacelles mounted between the wings as shown here.

QUESTION:—Arthur J. Lucas, Pomona, Calif. *Does the light fuel oil used for Diesel engines contain more power than gasoline?*

Answer:—FUEL OIL contains more heat per gallon than gasoline, but less heat per pound. As we buy this heat by the gallon, then the power cost is less when fuel oil is used, all other things being equal.

* * *

QUESTION:—J. K. Lamone, Bartlesville, Okla. *Why is the landing speed of an airplane higher at very high altitudes than near sea-level?*

Answer:—THE air is less dense at high altitudes, and as the lift is proportional to the density and speed, it is evident that the speed must be increased if the density diminishes.

* * *

QUESTION:—Sam L. Fries, Omaha, Nebr. *Why can't gunpowder or other high explosive be used to better effect than gasoline? I should think that a pound of gunpowder would give a whole lot more power than a pound of gasoline.*

Answer:—A POUND of gunpowder contains much less energy than a pound of gasoline. Gasoline is the most compact and lightest fuel for a given amount of power known at the present time—except acetylene gas. The heavy tank required for carrying acetylene, however, offsets any advantage that might otherwise lie in the use of this gas.

* * *

QUESTION:—George N. Adams, Freeport, Ill. *When wing tanks are used, is it advisable to provide drains for the leakage of the tanks?*

Answer:—THE wings should be ventilated to eliminate any gasoline vapor that might find its way into the wing, and drainage should also be provided so that the liquid can be drained out. Gasoline vapor is always dangerous, and an explosion within the wing has probably been the cause of many accidents that have been charged up to "cause unknown."

* * *

QUESTION:—Oscar Braatz, Helena, Mont. *Does the radio mast on a transport plane have any effect on reducing the speed? If so, is there any other method of installing an antenna?*

Answer:—YES, the radio mast as installed on a number of transports has a noticeable effect on the speed. In one case, the radio mast decreased the top speed by almost 7 m.p.h. A better method is to use a loose trailing antenna, or a long loose wire allowed to trail out behind the ship while in flight. This is drawn in when landing by means of a windless.

* * *

QUESTION:—Fred Sickles, Eau Clair, Wis. *Is it advisable to place the engines of a large biplane between the wings rather than to mount the motors in the wings? If the engine nacelles were exposed to the air on all sides (without being faired into the wings) would this increase the resistance?*

Answer:—IT IS entirely practicable to place the engines midway between the wings as illustrated by the accompanying English flying boat. The resistance of the engine nacelles may be somewhat greater, but on the other hand, the nacelles do not interfere with the lift of the wings as is the case where the nacelles are faired into the wings.

* * *

QUESTION:—O. G. Hamilton, Sandwich, Ill. *If an aviation engine intended to run at 1,800 r.p.m., is run at 2,000 r.p.m., is the wear much greater*

(*Concluded on page 52*)

Practical Lessons in Aviation

by JOHN B. RATHBUN

We now continue the all important subject of air resistance and effects of streamlining when bodies are moved through the air. This is the most important phase of aviation physics.

WHEN an airplane flies through the air, every part of the plane exposed to the high velocity air-stream creates resistance or "drag" which must be overcome by the thrust of the propeller. As explained in the previous lesson, the amount of this resistance varies with the size, shape and proportions of the various parts and also varies according to the "square of the velocity" within ordinary limits of speed attained at the present time.

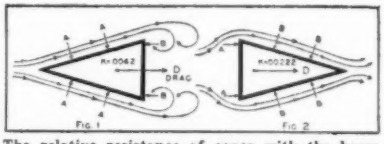
Therefore, in order to get the greatest possible speed with a given engine, or to fly with the least possible amount of power and fuel, this "parasitic" or useless resistance must be cut down to an absolute minimum. Every part of the airplane structure, no matter how small, contributes its bit to this waste of power and fuel—the wings excepted for the time being.

It was further pointed out in the preceding lesson that the resistance was due to two factors. First, to the "cyclic" disturbance of the air caused by the eddies, whorls and waves set into motion. Second, to the "skin friction" or the pure frictional resistance due to the air rubbing over the surfaces of the solid body. In either case, or both cases combined, differences of pressure are created that impede the progress of the body and cause drag. Some body shapes create a great deal of resistance for a given frontal area while others, commonly known as "streamline bodies," create comparatively little resistance, but in every case some drag is present under the best of conditions.

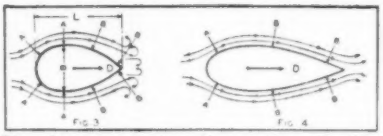
To observe the action of a solid body in a fluid current, the first tests were made by immersing the body in a trough of running water, the whorls and eddies then being directly visible to the eye. Later, the bodies were suspended in a uniform air current of known velocity, the air flow and turbulence being made visible by the introduction of smoke filaments or streamers in the air.

Such tests showed, in most cases, just why the resistance of certain bodies was greater than others because of the greater air disturbance or "turbulence" created by the shape of the solids. Some bodies created a tremendous commotion in the air, producing great eddies and energy losses, while in the case of other bodies, the fluid stream flowed smoothly about the bodies with little evidence of eddies and with little resistance.

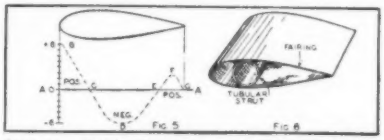
Literally, thousands of different shapes have been tested in wind-tunnels, of every geometric form and in every conceivable position, in order to



The relative resistance of cones with the bases away from and then facing the air-stream.



The elements of streamline sections showing effects of fineness ratio.



Pressure distribution curve and the method of fairing or streamlining a round tubular strut in order to reduce its resistance.

study losses due to parasitic resistance. It was discovered early, however, that the resistance was the least when the forward or entering end of the body was somewhat blunt while the body then tapered gradually down toward the rear, partially filling what would otherwise be a disrupted space at the rear filled with whirling eddies under a reduced pressure. This was just contrary to the former popular belief that the entering edge should be thin or pointed so as to more easily "split the air."

Just let us return to our cone example of Fig. 1, where the pointed end of the cone is pointed into the air-stream. A great turbulence and a low pressure is produced at the rear (base of cone). Since the pressure is greatly reduced at the rear, there is a strong tendency toward dragging the cone along with the air-stream in the direction (D). This is the "drag."

Since the pressure of the air is perpendicular to the surface at every point, as indicated by the small arrows, it will be seen that the pressure on the forward part of the cone assists drag since the pressure arrows (A-A) are inclined in the direction of the drag.

At the rear, the pressure arrows (B-B) oppose the drag, tending to reduce it, but as the pressure at the rear is very low, these latter arrows are not very effective in reducing the drag. Thus, when the pointed end of the cone enters the air-stream, we have a condition causing a lot of resistance.

Now, let us take the same cone in Fig. 2 (turned around) so that the base now enters the stream. The impact forces tending to cause drag (arrows A-A) are strong, but are opposed by the arrows (B-B). As the forces (B-B) are now acting under a much higher pressure than before, and also on a larger surface, they are much more effective in reducing drag than in the first case and, therefore, the resistance of the cone with the base pointing into the air-stream is very much lower than with the pointed end forward. The resistance coefficient (K) in Fig 2 is about half of that in Fig. 1.

Much better results are obtained, however, with the egg-shaped solid of Fig. 3 where the changes in air-flow are not so abrupt and so that less turbulence is produced at the rear. The pressure arrows (A-A) tend to cause drag as before, but are partly counteracted by the pressure arrows (B-B) which act against the drag.

The ratio of the length (L), in the direction of the stream, to the width (B), or: r=L/B, is known as the FINENESS RATIO and this ratio has much to do with the resistance.

And now we come to the so-called "streamline body" of Fig. 4 in which the fairness ratio is much greater than that of the body in Fig. 3, thereby causing less turbulence in the rear and very much less resistance. The air-stream flows smoothly around most of the body, breaking away only near the tail. The pressure arrows more nearly balance each other because the rear arrows, or pressures are not in turbulent air. When the fairness ratio is small, as in Fig. 3, the top and bottom streams collide more abruptly where they close in at the rear, thus causing severe eddies and higher resistance. With a greater fairness ratio, as in Fig. 4, the closing streams are brought more nearly parallel when contacting, hence with less eddying action.

The greatest thickness of a streamline body is approximately one-third the length from the leading (front) edge, the nose is rather blunt while the rear end of the tail is comparatively thin. Most of all, in the streamline body, there are no abrupt changes in the curvature that might lead to local eddying or "discontinuity."

In respect to the fairness ratio of a streamline body and its effect upon the resistance coefficient (K), I will give an example of a "family" of streamline forms with the same type of curvature but with varying values for the fairness ratio. The speed is in miles per hour.

The majority of streamline struts, of which many thousands have been de-

veloped, have the lowest value of (K) when the fineness ratio lies between 3.0 and 4.0.

EFFECT OF FAIRNESS RATIO
(Speed in M.P.H.)

Form Class	*Fineness Ratio*	*Coefficient (K)*
No. 1 NPL	5.0	0.00041
No. 2 NPL	4.5	0.00040
No. 3 NPL	4.0	0.00038
No. 4 NPL	3.5	0.00039
No. 5 NPL	3.0	0.00044
No. 6 NPL	2.5	0.00046
No. 7 NPL	2.0	0.00083

To this end, I will quote another family of streamline struts developed by the National Advisory Committee on Aeronautics. The speed in this case is in terms of feet per second instead of miles per hour.

EFFECT OF FAIRNESS RATIOS
(Feet per Second)

Form Class	*Fineness Ratio*	*Coefficient (K)*
(A)	2.5	0.00000902
(B)	3.0	0.00000836
(C)	3.5	0.00000812
(D)	4.0	0.00000795
(E)	4.5	0.00000812

Now, it will be interesting to compare the coefficient of a cylinder with the best result above, that of a streamline strut (D) having a fineness ratio of 4.0. The coefficient (K) of the cylinder, or cylindrical rod, is 0.000121, hence the resistance of the cylinder is 14.9 times greater than that of the best streamline form in the above table.

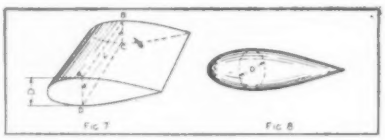
The resistance of the streamline body is dependent more upon the shape of the rear portions than on the shape of the nose, and in some cases a considerable portion of the nose can be cut off or otherwise altered without very greatly changing the coefficient of resistance. But the rear portions are very critical to changes in form and only slight changes will make a considerable difference in (K).

This is largely due to the fact that the "tail" of the section controls the direction of the top and bottom streams just before they collide and thus also controls the degree of turbulence at the rear. Streamline bodies and their properties cannot be judged from their appearance alone, and it will often be found that bodies which appear to be well streamlined actually present a great deal of resistance. Only an actual test can determine the value of the resistance coefficient.

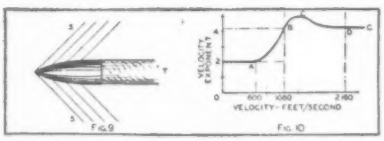
Wind-tunnel tests show a very peculiar distribution of pressure over the length of a streamline body and one that does not exactly agree with energy computations. Thus, at the top of Fig. 5 is a typical streamline body, while directly below it is a pressure diagram that indicates the pressure variations that take place throughout its length. The line (A-A) is the line of atmospheric pressure. Points above this line are above atmospheric pressure or "positive," while portions of the curve below (A-A) are below atmospheric pressure or are "negative."

The pressure peaks up at the nose (B) considerably above atmospheric pressure and then falls abruptly to atmospheric or "zero" pressure at about the zone of greatest thickness. From this point, a vacuum is produced at the rear which reaches a maximum at (D). Then the pressure becomes zero at (E). Near the tail, (E-F-G), we again have positive pressure or pressure above atmosphere. The positive pressures (B-C) and (E-F-G) cause resistance or drag, while the negative pressures (C-D-E) react against the drag and tend to propel the body into the stream.

These differences in pressure, as with eddying, are due largely to the "viscosity" of the air or its internal resistance. In addition, we have the frictional resistance due to the air rubbing along the surfaces of the streamline body, and as this rubbing continues over a greater surface with the streamline body than with a thin plate or sphere, it is evident that surface friction is more of a factor with streamline bodies than with plates, spheres or



Methods of computing presented area or frontal area of streamlined bodies.



The turbulence of a flying bullet (left) and a diagram showing how the resistance jumps up at speeds over 600 feet per second.

other short bodies where the turbulence is high and where the air-stream does not contact the body for any great distance.

Unfortunately, a streamline strut is not a very good strut or compression member for withstanding stresses in the structure of the airplane. It is much weaker in one direction than in the other, hence its strength is determined mostly by its width or smallest dimension. In order to combine the structural merits of the circular or tubular strut, which has equal bending strength in all directions, it is common practice to place a streamline sheath around the tubular strut to reduce the resistance of the tube. This streamline casing is known as a "fairing" and can be made of thin metal sheet or wood, depending upon conditions. This practice gives a good strong light structure which has a much lower air resistance than with the tube directly in the airstream.

So far, we have only considered these streamline forms as struts, but the same idea can be applied to bodies known as "solids of revolution," that is, bodies having a circular section produced by revolving the streamline outline on its long axis as indicated by Fig. 8. Such bodies are employed for the hulls of dirigibles, the fuselage of airplanes, nacelles and similar parts. Figures of circular section, streamlined, are called "fusiform bodies" or sometimes, "pisciform bodies" because they resemble the body of a fish.

In computing the resistance of a streamline strut or bar, we use the same general equation as in computing the resistance of the other bodies described in the previous lesson. Thus:

$$(R) = K \times A \times V^2$$

Where: R = total resistance in pounds.
K = resistance factor which depends upon the form of the body.
A = projected area, or area in square feet presented to the air-stream.
V = velocity in miles per hour or feet per second as specified.

The presented area of a strut is the area (A-B-C-D) shown in Fig. 7, which is the thickness or "diameter" (D) multiplied by the length (L), both dimensions being in feet. Thus, $A = d \times L$. In the case of the fusiform body, Fig. 8, the presented area is the diameter (D) of the circle drawn at the greatest diameter of the body. If (D) is this diameter, then the presented area becomes.

$$A = 0.7854 \times D^2$$

If the section of the fusiform body should be square or rectangular, as it often is in a fuselage, then the area of the square is used instead of the circular area.

Now, while we have stated that the resistance varies with the "square of the speed," or as V^2, this is not exactly the case under all conditions although this statement is close enough for most practical cases up to the velocity of sound waves. The coefficient (K) is slightly lower between 25 and 90 m.p.h. than it is below this speed, and when we get above 400 m.p.h., the laws of resistance change entirely. But, between 25 m.p.h. and 300 m.p.h., the "velocity square law" will be close enough for our purpose and need not be modified.

At speeds below 25 m.p.h., the air hugs the bodies more closely, hence a greater portion of the resistance is skin friction. At speeds up to 400 m.p.h., the air stream is split open wider and there is a greater loss due to turbulence or "cyclic" disturbances. When the velocity of sound is reached, at about 1,080 feet per second, much of the energy is converted into sound waves with a tremendous increase in the resistance. The value of (K) for a rifle bullet is vastly different than for the same body at ordinary speeds as will be seen from Fig. 9.

Here we see that the turbulence created by the bullet at (T), is greatly prolonged. But most interesting of all are the sound compression waves (s) that are always present at a speed above 1,000 feet per second. These sound compression lines are shown sharply and clearly on a photo of a

(*Concluded on page* 55)

Details of Knight-Twister Wing

by VERNON W. PAYNE

In response to many requests from our readers, we show the details of the wing structure employed with the Knight-Twister Vest-Pocket Pursuit ship.

AND now we show the wing details for the vest-pocket biplane to which I have given the name, "Knight Twister." Together with the fuselage details, which were published in the November issue of POPULAR AVIATION, you will now have a complete layout of this snappy little job.

Attached are two drawings, one of which shows the wings while the other drawing displays the ailerons. The wing drawing shows only half of the upper and half of the lower wing because the two halves are identical except for the "hand."

The top line of the spars is straight while the bottom is tapered, the taper starting at the root rib, runs out to the last rib. There is no taper where they run through the center-section and fuselage. I have made the top spar double thick, from the 27-inch rib to the inner end of this spar which is located in the center of the fuselage. In other words, the spar must be two-inches thick at the 27-inch, the 28½-inch, the 30-inch and, in the top wing, at the 31½-inch ribs.

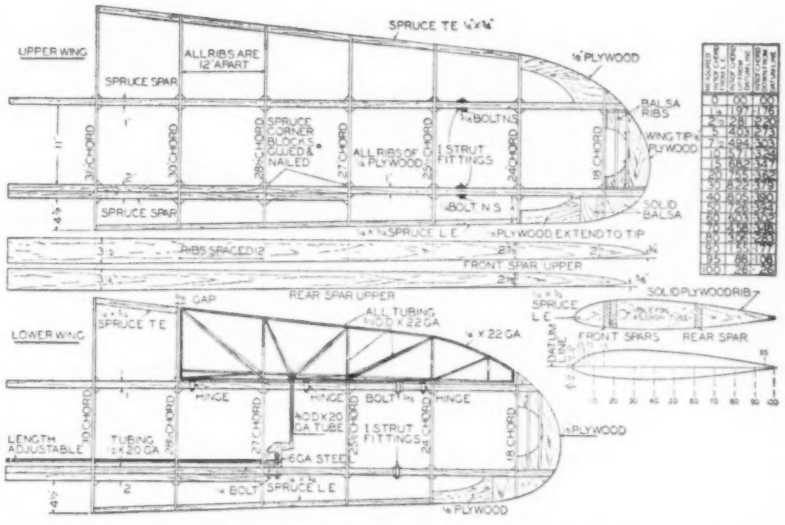
The rear spar is more than strong enough at the one-inch thickness, and there will be no danger of flutter. The inside distance between the spars is 11 inches. All of the ribs are spaced 12-inches, center to center.

To eliminate any danger of flutter, the upper wing is made of longer span than the lower wing. When the two wings are tied together, each of the wings contribute a different natural period of vibration, hence this connection dampens out vibration that would be likely to arise in exactly similar upper and lower wings. Again, with the extra strong spars, we need have no danger of excessive flexibility.

We are building this latest type of Knight Twister at Cicero, Ill., and she is a honey. This one is equipped for airwheels and possibly for brakes. It will not be long before we will have some photos to show you, and I know that you fellows will appreciate her fine qualities as well as we do.

I cover the wings with 1/32-inch plywood, for this not only makes a fine covering but it also eliminates the necessity of internal wire bracing in the wings. The complete wing is then covered with cloth which gives additional strength, because the cloth ties the whole thing together and protects the plywood from being dented or marred while in service. It is possible to get a very fine finish with the cloth in the usual way by first doping with clear dope and later with pigmented dope.

Some lightplane builders use two coats of clear dope and two coats of pigmented dope, but some of the dopes do not properly fill the pores of the cloth with only four coats and therefore the finished job does not have the highly desired glass finish. If the structure is strong enough to withstand the pressure due to the shrinking of the dope, then six or even eight coats can be used to insure a smooth finish.



Details of the wing structure, the frame of the upper wing at the top and the lower wing at the bottom of the drawing.

In general, there are two kinds of dope. One is the cellulose acetate dope while the other is the cellulose nitrate type. The former is expensive but it does not burn quickly—it only smoulders—and it does not shrink the fabric as much as the nitrate type. The nitrate dope is the more popular for it is cheaper, but it burns quickly when ignited and does not give quite as good a finish. The regular practice of using six coats, including the pigmented dope, adds about 4½ ounces of weight per square yard of fabric. One square yard of fabric also weighs 4½ ounces so that the total weight of the doped fabric is 9 ounces per square yard.

I make the ribs of ¼-inch plywood, using the plywood cemented with waterproof glue. The ribs are cut out of the solid and holes are cut out only where the aileron control tube passes through. If you wish to wire the upper wing for wing lights, another set of holes will be needed in the upper wing ribs for running the light wires. The nose pieces of the ribs are cut in ¾-inch to allow a ¼ x ¾-inch spruce strip to be inserted. This acts as the leading edge strip.

The trailing tips of the ribs are cut off ¾-inch to allow for the application of a spruce trailing edge strip. The strip is ¼ x ¾-inch and is planed down to the proper form, the tips cut off the ribs being used as patterns for the section of the trailing edge. Both the T. E. and the L. E. spruce strips are nailed and glued in, using aircraft cement coated nails and cold-water casein glue. This casein glue is waterproofed and should be made to the Army Air Service specifications.

In the upper wing we have seven different ribs, all of the same shape but tapering in the length of the chord. We make full size rib drawings on thin plywood and cut them out with tin snips. These are used as patterns, layed out on the ¼-inch plywood and then the curve is transferred by drawing a pencil around the edges of the pattern. This is an easy way of making as many ribs as we may wish of each size of rib.

At the point where the wing tip begins to curve, we used some ⅛-inch plywood. This forms a part of the trailing edge, part of the leading edge and the bow end or wing tip as well. Where the wing tip curves, we place a balsa wood block.

When covering with 1/32-inch plywood, the joints should be lapped and the joint tapered by shaving with a knife and smoothing with sandpaper.

Notice that the spars are parallel, and when cutting out the ribs for mounting on the spars, be sure that lines on the ribs are square with the datum line or the line drawn through

the leading and trailing edges. While not shown on the drawing, there are ¼ x ¼-inch spruce strips running the full length of the wing. They are underneath the plywood covering (between the spars) to reinforce the covering. This will prevent warping and twisting with changes in the weather.

The aileron is made of ⅞-inch outside diameter tubing with 0.028-inch wall thickness while the trailing edge of the aileron is of ¼-inch outside diameter tubing. The entire aileron is oxy-acetylene welded, but not with an electric arc since the latter often results in crystallization and breakage.

The drawing of the aileron shows how the spar of ⅞-inch tubing is braced and connected to the ribs and trailing edge so that it forms one well trussed structure that can stand a lot of twisting without going to pieces. Take particular notice how the aileron spar-tip is bent back ⅜-inch because, when a wing-tip is tapered and the aileron is not built with the aileron spar-bent back, the aileron spar will hit or bump the rear spar-tip of the wing. It often simplifies matters, when building an aileron to build it on the wing, using the wing as a jig for the aileron.

The wing "I" struts are cut out of ⅜-inch plywood. On the dotted line, running from top to bottom of the strut, as shown, is a ⅜-inch square strip glued on each side of the plywood strut to stiffen the strut sidewise. The strut is faired with balsa wood to a streamline section, then wrapped with cloth and thoroughly doped to keep out moisture. The fairing and finishing of the strut is best done when the strut is on the wings and when assembled on the ship.

Note that there is only one flying-wire fitting. This flying-wire is not actually needed, for the spars are stiff enough when used as cantilevers, but it is placed there for appearance and for a sense of added safety as much as anything else. It is run from the upper wing at the front spar "I" strut, down to the front landing gear fitting on the lower part of the fuselage, or else to the No. 7 lower station.

A jig is needed for assembling the wing. We used a table made of 2 x 4-inch lumber and on the top of the table we marked centerlines with chalk. Then the positions of the spar and rib centerlines were marked. When the wing is assembled on this jig it is upside down for the top surface is a straight line from wing tip to wing tip. Next, take some one-inch boards and out of one edge cut the shape of the upper surface of each rib. There should be one of these boards for every rib in the wing.

These one-inch pieces were nailed on the table at the points and on the centerlines of the positions marked on the ribs. They acted as part of the jig and held the ribs in place when applying the spars. The table must be straight and level and the one-inch strips must also be leveled so that the L. E. and the T. E. are straight lines through each rib. The spars are held in place on the jig by small angle-irons while applying the ribs.

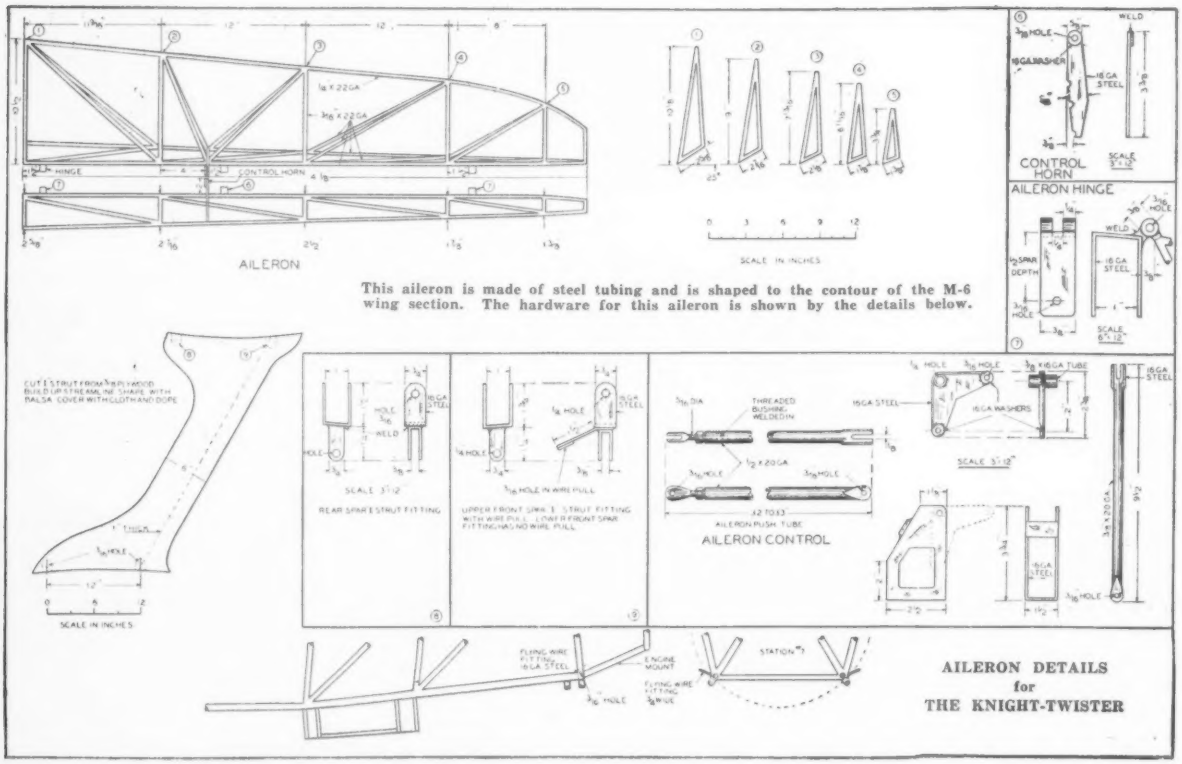
Much depends upon the accuracy with which the ribs are assembled, their alignment upon the spars and the straightness of the leading and trailing edges. In the first place, it will be difficult to maintain the covering without bags and wrinkles when the ribs are out of line, and second, the proper function of the wing section will be diminished.

Any sagging or bagging in the covering will always cause a loss of power and speed, for such hollows set up turbulent eddies that interfere with the flow of air around the airfoil and destroy the performance. In one small ship, where the veneer was not properly secured so that it wrinkled up in damp weather, the loss of speed was 17 m.p.h.

And another important point is the location of the center of pressure in regard to the center of gravity. In one of my former articles, I showed how the wing was adjusted in respect to the center of gravity, and in my next issue, or before you have the wing completed, I will show you how to locate the center of gravity itself.

Lack of the proper balance, due to improper adjustments of the center of pressure and the center of gravity, not only increase the difficulty of control, but also increase the danger of stalling and causes a loss of power. If the ship is nose heavy or tail heavy, then it will be necessary to apply the elevators continually.

There must be some adjustment of the wings, either back or forth, to make up for variations in weight of different types, makes and sizes of engines; for variations in the weight of the pilot and so forth, and this adjustment will be explained in the following article.



This aileron is made of steel tubing and is shaped to the contour of the M-6 wing section. The hardware for this aileron is shown by the details below.

AILERON DETAILS for THE KNIGHT-TWISTER

What Our Readers Are Building

A department devoted to our readers' activities in airplane, glider and engine construction, showing the latest developments.

Carl Sturgeon is Entered

CARL STURGEON, Pampas, Tex., sent us some shots of the Model LN Heath that he and his partner are building. They expect to equip it with a Long Harlequin motor which should shove her along with expedition.

They say, Mr. Sturgeon and his partner Mr. Ralph Chisum, that they built it from the raw materials and have covered it with Grade A Flitex. The shots show it up as a very neatly constructed job, and trust that the partners will send us some more dope on her make-up as soon as she is test hopped.

Two Brothers On the Job

CHARLES and Ted Michalski, 85 Ames St., Methuen, Mass., have completed a mid-wing monoplane, but it can't be tried out because the state of Massachusetts will not permit the flying of unlicensed ships. Massachusetts has revised her ideas since the days of the Boston Tea Party.

The ship has a span of 27 feet and 6 inches with an overall length of 17 feet and 3 inches, and is entirely of fabric covered wood construction. The weight is approximately 275 pounds, the powerplant being a suped up Indian "74" motorcycle engine.

Harold Via Here Again

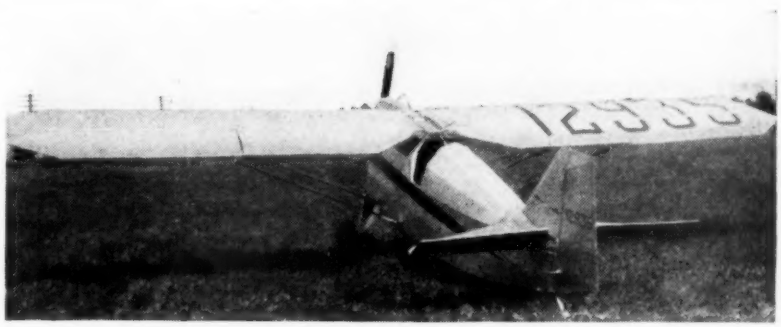
SOMETIME ago, Harold Via sent us a picture of his ship, a front view to be exact, but one of our lightplane fans requested that we show the ship again and we, as a response, show the three-quarter rear view attached. The appeal to our readers seems to lie in the fact that the wing is placed squat down very close to or on the top of the fuselage and thus is a pleasing change from the conventional parasol types that are so common.

Cold Weather Hints

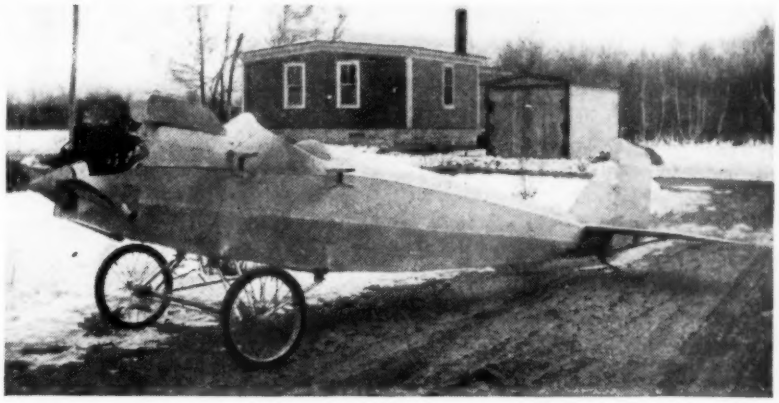
COLD weather operation means a lot of careful managing if we are to keep our old bus in the air during the winter. In the first place, only the highest grade of gasoline is permissible—gas that is best adapted to cold weather operation.

On snappy mornings, heat the oil before pouring it into the crankcase for two reasons. First, because the hot oil makes starting easier. Second, because the oil starts lubricating right away and thus saves wear.

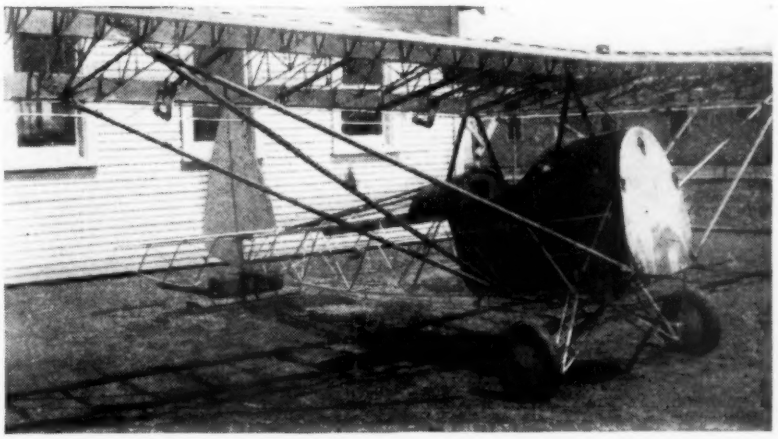
Here's a Group of Homemade Lightplanes



The ship built by Harold Via shows careful workmanship and design. It is one of the few ships of the monoplane type entered in this column that employs a "flush wing," that is, a wing mounted on the top of the fuselage.



Here are the vital organs of the Michalski ship, minus the midwing that is supposed to sit snugly on the two stub ends shown projecting out from the side of the cockpit. The State of Massachusetts gestured "thumbs down" and there we are.

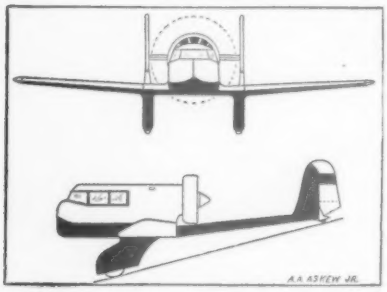


This is as far as Carl Sturgeon got before he decided to send us a picture of his production. It's the kind of a picture we like, however, for it shows the construction of the internal organs very clearly. When Carl and his partner get the kicker aboard, something should be stirring in Texas.

Dream Ships by Our Dreamers

Here we have an open forum for the ideas of our readers who have been bitten by the designing bug. All are interesting, some are good, some are fair and some are—

A. A. A., Jr., Shows a Pusher



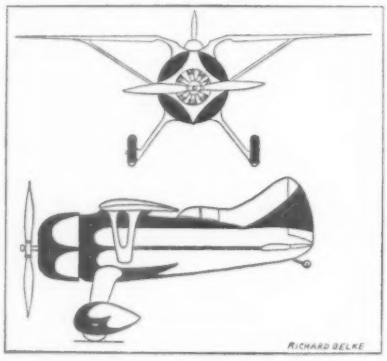
A. A. Askew, Jr., is an old friend (or a young friend of long standing) who sends us certified evidence of a remarkable dream having to do with pusher ships. On looking at this ship we might jolly well say that she is actually overflowing with visibility, front, sides and all around, which is one of the most desirable characteristics of a pusher.

One point worthy of note is the fact that the two tail booms extending toward the tail group are also integral with the landing gear so that all of the wind-splitting equipment is contained within one housing. This can stand further development.

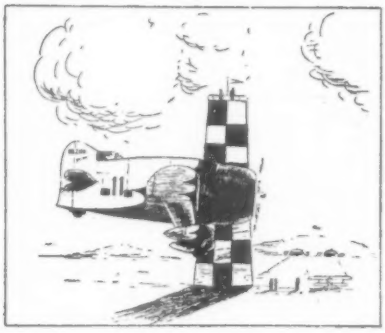
A Hot Gull-Wing

STIMULATED by a light lunch before retiring, Richard Belke tossed on a hot pillow with visions of his favorite Dream Ship flitting through his mind.

Now, looking at the results of this dream, below, we witness a gull winged speedster of unique design which should do a flock of m.p.h. without much effort. However, we cannot highly commend this job from the standpoint of visibility for the pilot's zone of vision is limited by the position of the wing.



A Gee-Bee Hard at Work



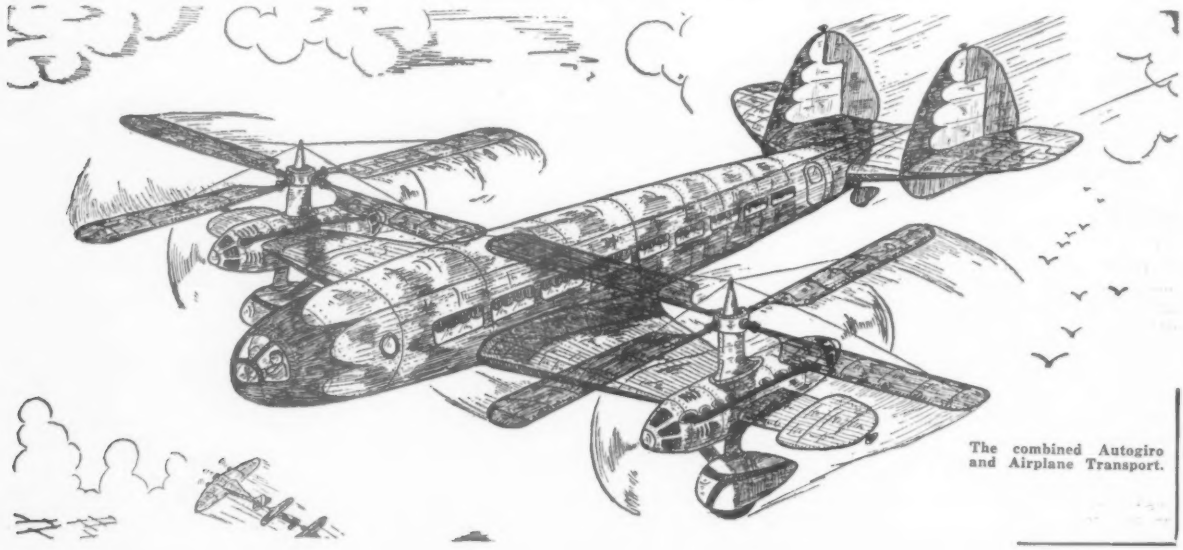
THIS picture of a Gee-Bee, rounding a pylon, by An Unknown Soldier, is such a nice pen and ink drawing that we could not resist printing it although it hardly comes under the scope of this department.

This little sketch is full of speed and very accurately portrays the ship on its historic record breaking flight. In fact, I have a photograph which is nearly a counter-part of this picture which is not half as speedy as the sketch. We only regret that the confines of this department made it necessary to make this cut so small.

A FINE DRAWING OF A GIANT AUTOGIRO TRANSPORT BY CERICH

L. CERICH, whose invention of an Autogiro transport ship, below, is to be congratulated for his imagination and artistic abilities as well. While most unusual in appearance, it would seem that the idea might be worked out in practice for there are no unusual nor untried features shown.

A glance at one of the two power plants will show that two engines are mounted in the nacelle, one with a tractor and the other with a pusher prop. Rising out of the nacelles are the pedestals or pylons carrying the two typical rotors. The power plants in turn are mounted on the tips of the wings, and beyond the nacelles are the ovoid ailerons.



The combined Autogiro and Airplane Transport.

Final Notice for Contestants

HERE'S the last call for all intending entrants to the big contest, and the parting instructions before the bell rings.

Just to remind you, this contest closes on December 26, 1933, and no photographs will be opened nor returned that bear a postmark later than this date.

Send your photographs addressed to EDITOR MODEL CONTEST, POPULAR AVIATION, *608 S. Dearborn St., Chicago, Ill.*

Closeup view of cabin, showing the last emergency exit window (right), the wing filleting and similar details of the cabin.

IT WILL not be long now until we know who's who in the model building contest! Promptly, on December 26, the time for receiving entrants will close, and then the big job of sorting photographs will be started by the judges.

Just at the present time we have no means of estimating the number of contestants, but the fact that over 4,000 scale drawings were sent out to our readers, leads us to believe that about 6,000 model builders will be lined up, ready for the starting gun. We have no doubt that this will be one of the greatest model contests ever held both in the matter of numbers and interest.

Our photograph files contain a tremendous number of photographs from readers who have already completed their work and sent in their photographs for the preliminary trials. But that model of yours may have just that accuracy of touch and that degree of finished workmanship that will bring down one of the worth while prizes in this contest. You never can tell. And again, there are relatively few entrants compared to the number of prizes so that the chances of winning a prize are correspondingly increased.

You understand, of course, that you are simply to send us one or more photographs of your model—not the model itself. Then, after eliminating the obviously unfit, we will ask you by letter to send the model itself for the final judgment. Once again we will ask you *not to send the model* until we ask you to do so.

On each of the photographs, you are to paste the attached coupon, or a facsimile of this coupon, giving your name and address. Failure to do this may spoil your chance of winning, for unless we have your name and address it will be impossible for us to get into touch with you at a later date. Last year, carelessness on this point spoiled the chances of a number of entrants who produced models in the winning class. If you do not wish to clip your magazine, make a duplicate of the coupon and send that in.

Any photographs will do, commercial photos, snap-shots or any other sort of photograph as long as it is sharp and large enough so that all of the details of the model stand out clearly. One view of the model will do, but two or three views will give a better idea of the model and make it easier for the judges.

Many believe that the excellence of the photograph has much to do with the chances of winning a prize, but this is not the case. It is almost impossible to cover up defects in the model that the camera will not reveal—no matter how poor or how good the photograph may be. This is one of the lessons that we learned in the last year's contest. Cameras exaggerate defects such as wrinkles, uneven finish or rough workmanship.

But, when it comes down to the final selection, where there will probably be hardly an eyelash difference between two models, then we will have to get the original models in our hands. At that time, we will notify you to send your model to us, packed very carefully, insured and transportation charges paid. This is the only expense that you will have to bear excepting the purchase of the materials for building the models. And, you can enter as many models as you wish, two, ten or a dozen. They can be made from raw materials that you have around the house, built up of parts purchased from your dealer or from the very excellent kit sets advertised in this magazine.

Awards will be made on the basis of workmanship, finish, fidelity to the large plane and accuracy of dimensions. The model may be a flying or a non-flying scale model, but its flying ability will have nothing to do with winning

Your name and address must be on the back of every photograph submitted in this contest. This coupon, or a facsimile of it, should be pasted on the back of each photograph

POPULAR AVIATION SECOND INTERNATIONAL MODEL AIRPLANE CONTEST
608 South Dearborn St., Chicago, Ill.

Please enter this photograph of my competing model in your contest. My entry is an accurate model of the Boeing "247."

☐ Flying model. ☐ Non-Flying model.

Name .....

Address .....

City..... State.....

a prize because we have no means of trying out or testing flying models. If your model is a flying type, it will probably be more satisfactory if the rubber motor is removed.

Last year we had so much grief with flying models that we wish to give you the benefit of our experience. This trouble came when the entrants tried their models and crashed them during the tests, thus making it necessary for them to withdraw at the last moment. Many excellent models were automatically eliminated from the contest in this way.

It is our aim in all of our contests to promote good workmanship and design above all other features. We will leave the flying tests and races to other model organizations, not because we don't believe in them but for the reason that it is impossible for us to embrace so much of the field over such a large territory. To properly conduct a flying contest, the owners of the models themselves should be present to do the flying, and it is easily seen that it would be impossible for us to take care of several thousand contestants.

In this contest we have offered the finest prizes that have yet been presented, this being made possible by the cooperation of the Boeing Airplane Company and United Air Lines. They are practical prizes such as would be most desired by model fans, giving them direct actual contact with the world's largest airplane factory and the world's largest air line.

The Contest Medal

This is one of the medals that will presented to all prize winners in POPULAR AVIATION'S Second Annual International Airplane Model Contest. It will be a beautiful memento of the winner's skill in building model airplanes.

The Gruman Pursuit Plane

(*See page* 67)

ONE of the latest acquisitions of the U. S. Army Air Corps is the Gruman pursuit plane which has several unusual features. This new ship is shown in detail by the full page photograph on the rear inside cover, caught by P. A.'s photographer as it was resting at the Municipal Airport, Chicago, Ill.

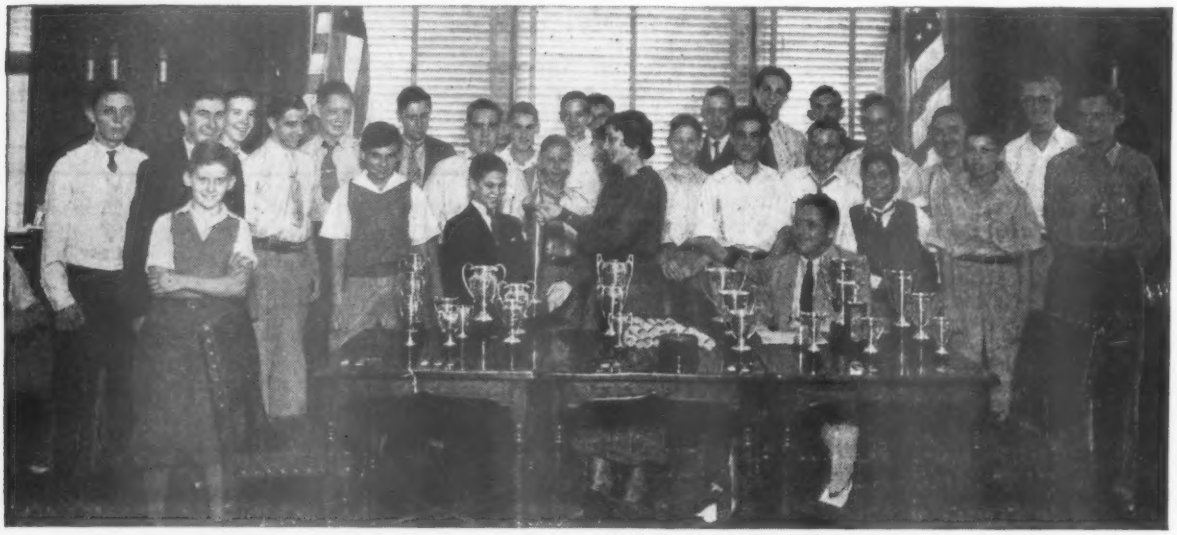
First, and most conspicuous of the innovations, is the retractable landing gear which retracts in a peculiar manner. The landing gear struts are so hinged that they swing up sidewise, when the ship is in the air, the wheels fitting into the round holes cut in the fuselage for this purpose. This is one of the very few, if not the only example of a high-speed pursuit ship equipped with retractable landing gear.

The next item of interest is the streamlining of the short and stubby fuselage, which follows a rather unusual outline. This little plane is said to be the last word in efficiency, hence this body must be a better streamline type than the pursuit fuselages that have preceded it. No performance figures are available at the present time, because of the army regulations, but it is hoped that we will soon be able to publish this data for our readers.

THE MISSISSIPPI VALLEY AIRPLANE MODEL TOURNAMENT IS A SUCCESS

THERE was a lot of excitement among the youthful model builders in St. Louis, Mo., and vicinity when the Mississippi Valley Airplane Tournament announced the prize winners in its recent airplane model contest.

This model tournament was sponsored and promoted by Stix, Baer and Fuller Co., one of the largest department stores in St. Louis, and many beautiful prizes were given as will be seen in the photograph below. In this picture, Mrs. May Haizlip, the famous woman racer, is shown presenting the Grand Prize to a Junior airplane model builder—Lehman Lamont. Her equally famous husband, Jimmy Haizlip, is shown seated at the right.



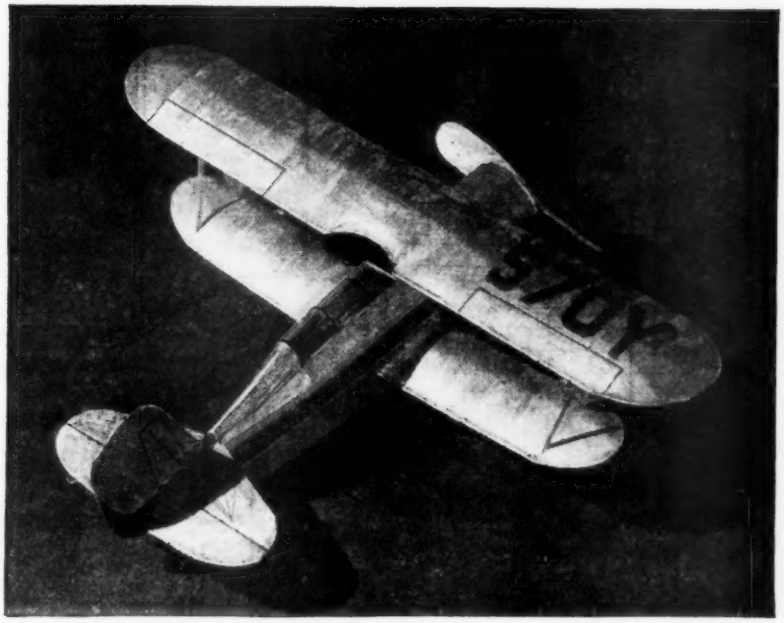
Mae Haizlip making the presentation of prizes at the St. Louis Model Contest. James Haizlip is shown seated at the right.

Building the Stearman Model 81

by

JACK KNOBLE

Professional model designer and exclusive contributor to the Model Department, POPULAR AVIATION.



Here is the completed model of the Stearman Model 81, which will well repay your efforts by its excellent flying ability and appearance.

HERE'S the latest development by the Stearman Aircraft Company—a closed cockpit biplane. It was shown on the cover of the December issue of POPULAR AVIATION from which you can get the color scheme.

The model has a 17½-inch wing span, is 13¼ inches long and has a height of 4⅜ inches. Believe me, she's a neat flyer and has real performance. Now, here's the lowdown on the job.

FUSELAGE

Cut out the fuselage formers from 1/16 inch sheet balsa, being sure to cut out the inside of each former to allow room for the motor stick. The two parallel stringers, close to the centerline on the side view, are then cemented to former No. 2. There are two stringers, on each side, of course, and the distance between the formers are marked off on these stringers.

After the cement has set on former No. 2, work back toward the tail, inserting a former and cementing the two stringers to it on each side. Cement them one at a time until they are all in and the cement has dried.

Cut out eight pieces of 1/16 inch balsa as shown between formers No. 1 and No. 2 and cement them in place. Then lay formers No. 1 on them, and after the cement has dried, sand them round on the outside edges so as to produce an even smooth curve down to former No. 1.

The motor stick and cowl are very simple and easily made as shown in the detail drawing above the side view. There are two washers between the propeller and the cowl.

LANDING GEAR

Cut a piece of balsa, ⅛ x 1/16 x 2¾ inches, insert it through the fuselage and cement it to the stringers on which it rests. This is shown in the front view. Now, assemble the rest of the landing gear as shown. The streamline is produced by filling in the corners with wood filler, and then the wire braces are cemented in position. The wheels are of the solid balsa type, with a paper disc cemented to the outside for streamlining them. You may use any method you like, but I believe it is best to fasten the wheels to the struts.

WING CONSTRUCTION

Scale out the ribs by drawing ⅛ inch squares on a sheet of paper and following the curve as shown on the side view. The leading and trailing edges on both wings are strips of ⅛ x 1/16 inch balsa. The lower wing is cut right in the center so that it can be given a dihedral angle. Now, apply a generous dab of cement on this cut so that the wings will be held at the proper dihedral after the cement sets. Cover both wings with superfine tissue, using blue tissue for the letters. Give one water coat, one coat of banana oil and one coat of silver paint.

TAIL SECTION

The rudder and elevator are layed out and built right on the plans. Use 1/16 inch square balsa and bamboo. Cover these frames with superfine tissue and dope them the same way that you did with the wings. Lay them aside to dry.

PAPERING THE FUSELAGE

Using small squares of superfine tissue, paper one square at a time, working very carefully and neatly around the landing gear struts and the bottom wing. Start papering from the rear and proceed toward the front.

After papering, cement the celluloid cockpit cover in place, using pins to hold it until the cement has set. The thin double lines show where a black stripe should be applied.

ASSEMBLY

Cement the elevators in place with the rudders right on top of them. Fit a piece of ⅛ inch flat balsa in the space where the wheel connects. Add the blue decoration to each side.

Now get the length of the wing struts from the front view and cement them in place or on the lower wing. Lay the top wing on them and cement. Next, carve the propeller, being sure to do a good job on this important part. Now, paint the fuselage and add all the little details as shown on the plans.

Make a wing clip to fit the motor stick and use Ambroid for fastening it to former No. 1.

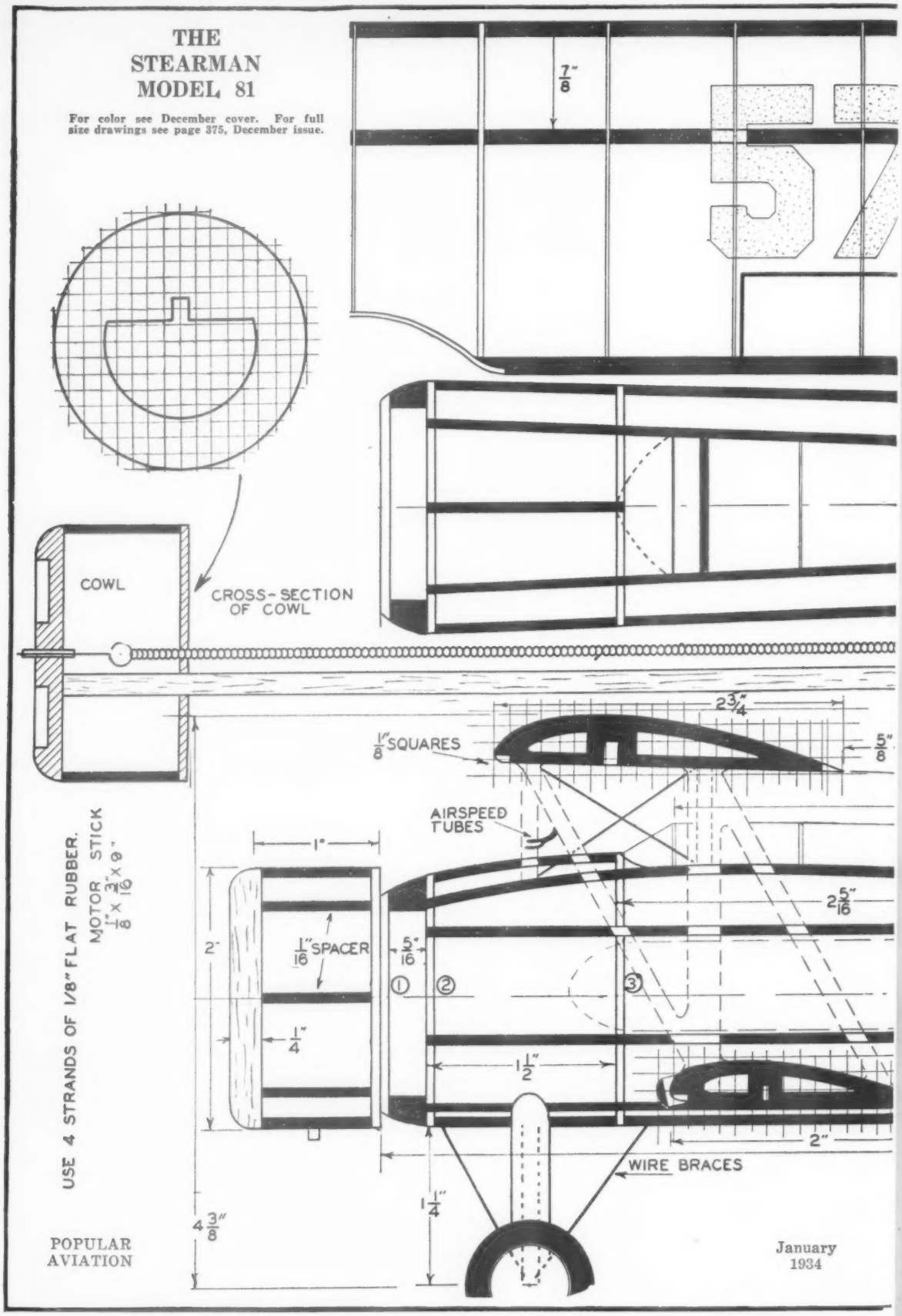
ADJUSTING THE MODEL

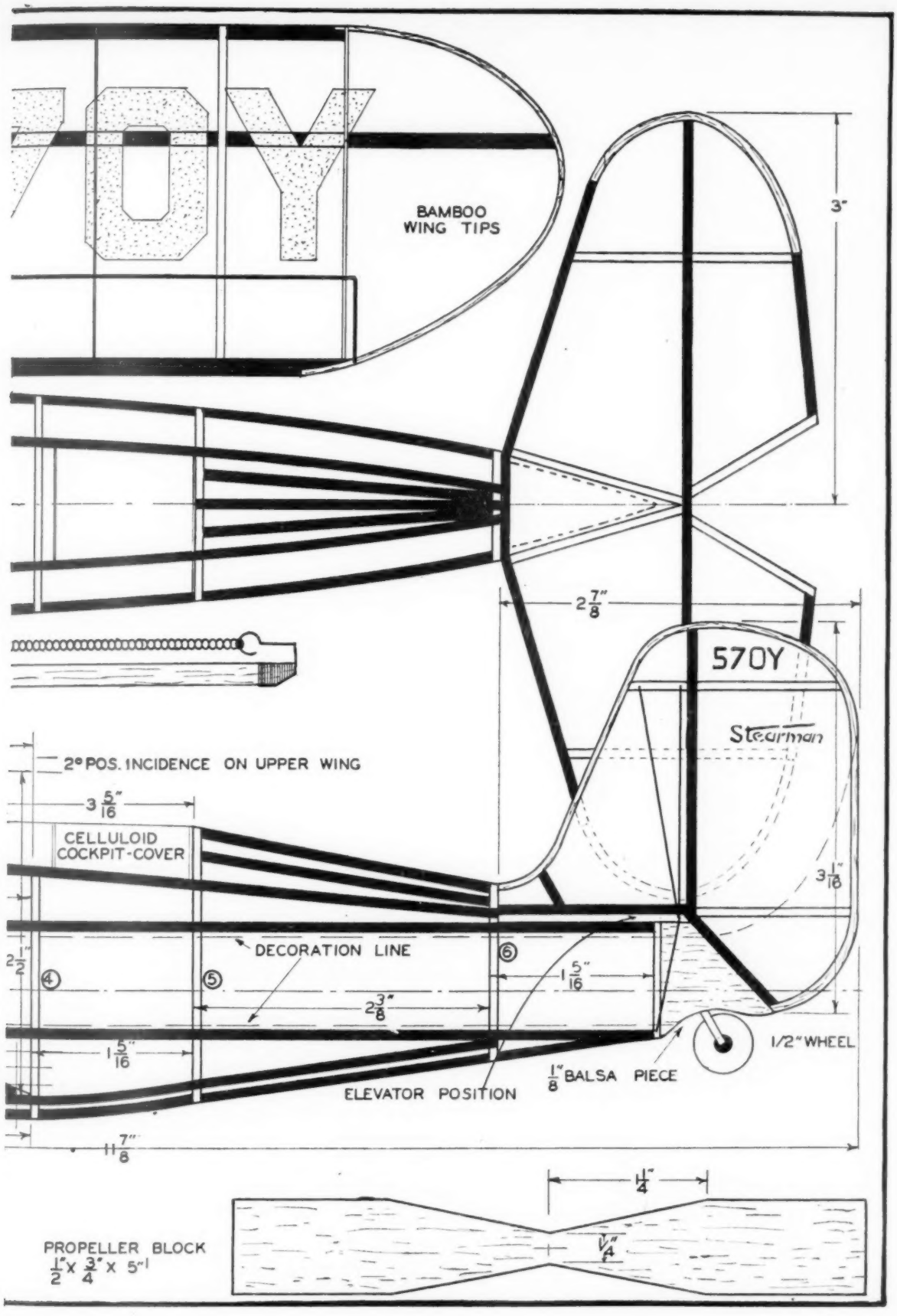
After the rubber motor is in place, test the model by hand launching it and allowing it to glide. Where possible, make this test over long grass so that it will not be damaged if it should nose dive. If in proper adjustment, it should glide forward for five or six feet for every foot of height above the ground.

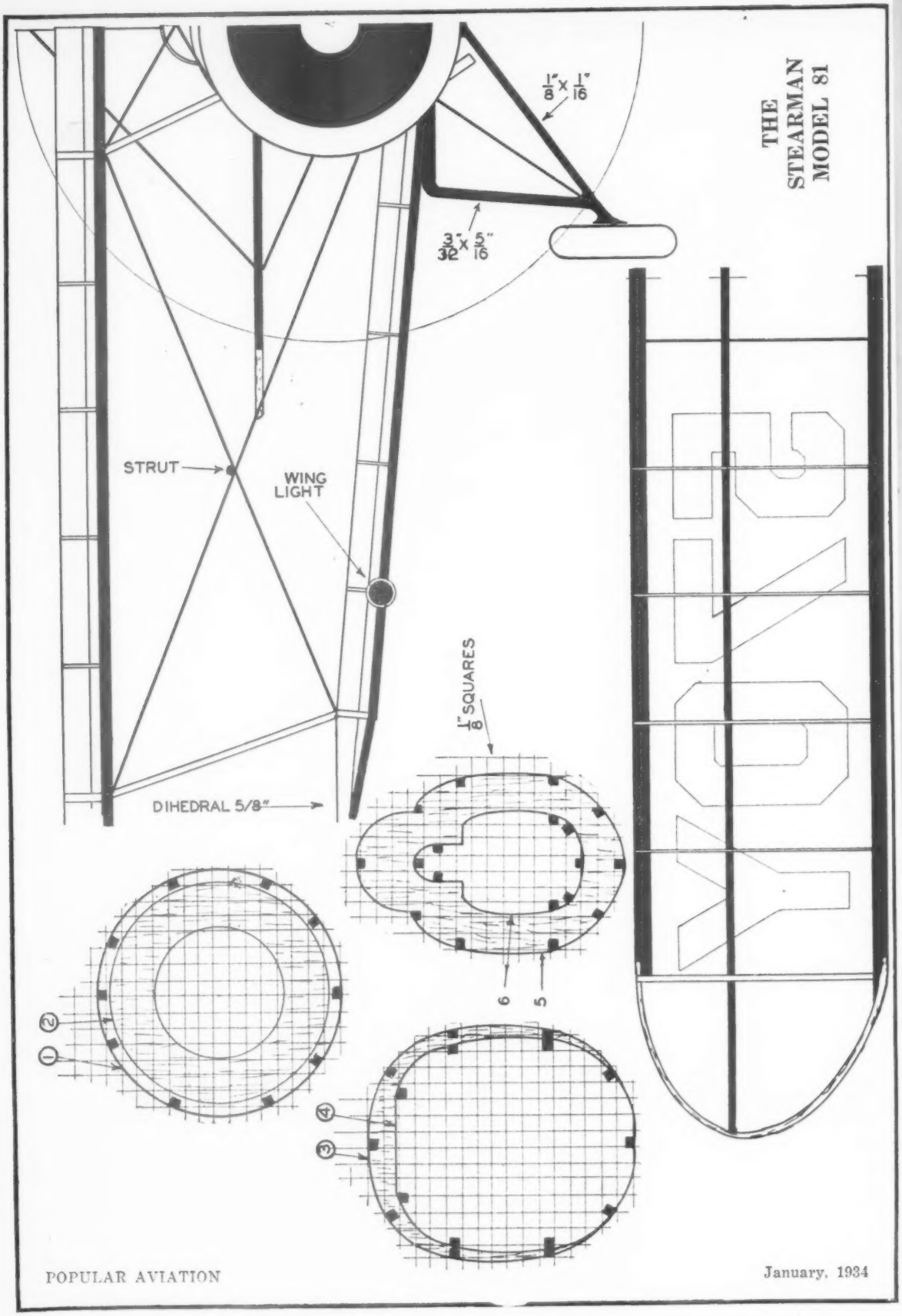
If everything is O.K., then wind up the rubber, about 150 turns (for a beginning) and launch it for its first flight. After a few trials, it is a good idea to try out the effects of several propellers, for there is always one propeller, out of a dozen or so, that gives the best results with any individual model.

THE STEARMAN MODEL 81

For color see December cover. For full size drawings see page 375, December issue.




BAMBOO
WING TIPS
3"
2 7/8"
570Y
Stearman
2° POS. INCIDENCE ON UPPER WING
3 5/16"
CELLULOID
COCKPIT-COVER
3 1/16"
DECORATION LINE
2 1/2"
④
⑤
⑥
1 5/16"
2 3/8"
1 5/16"
1/2" WHEEL
1/8" BALSA PIECE
ELEVATOR POSITION
11 7/8"
1 1/4"
1/4"
PROPELLER BLOCK
1/2" X 3/4" X 5"


THE STEARMAN MODEL 81
1" x 1"
8 16
3" x 5"
32 16
STRUT
WING LIGHT
1" SQUARES
8
DIHEDRAL 5/8"
6
5
2
1
4
3

Rice Paper Coverings

THE rice paper commonly used for the covering of model airplanes is a product of ancient China. The first paper was made in the province of Cheklanh and it is still being made there by the same methods. The first rice paper was made as a medium on which to paint the water colors for which the Chinese are well known.

During recent years, more modern methods have been adopted by a few makers although the original methods are still in use in many places. It is interesting to note that the paper made by the crude methods developed many years before the Christian era, is still considered the best grade and brings the highest prices.

Contrary to the common belief, rice paper is not always made from the rice plant. True, the best papers are made from rice straw, but bamboo and mulberry twigs are very commonly used for the stronger grades. These stronger (or tougher) papers are not considered to be of such high quality as those made from the pure rice straw and in spite of their greater durability, command only about half the price of the finer quality.

True rice paper manufacture begins with the stacking of the rice straw in the fields, sheltered from the wind and sprinkled with water daily. The bundles are turned over several times a day to insure complete wetting. At the end of two weeks, the continued wetting has softened the straw fiber. and then the straw bundles are broken and put into vats with lime and water.

A water-buffalo is used to macerate the mixture of lime and straw. Usually a child is employed to lead the buffalo around and around the vat for about thirty minutes to secure, by the trampling, a complete mixture of the lime with the rice straw.

The macerated straw is then removed from the vat, stacked into piles and allowed to stand. The Chinese say that when steam rises vertically from the pile, decay is taking place and then it is time to turn the pile. The decaying process is continued for three to six days, the straw being turned repeatedly during that time.

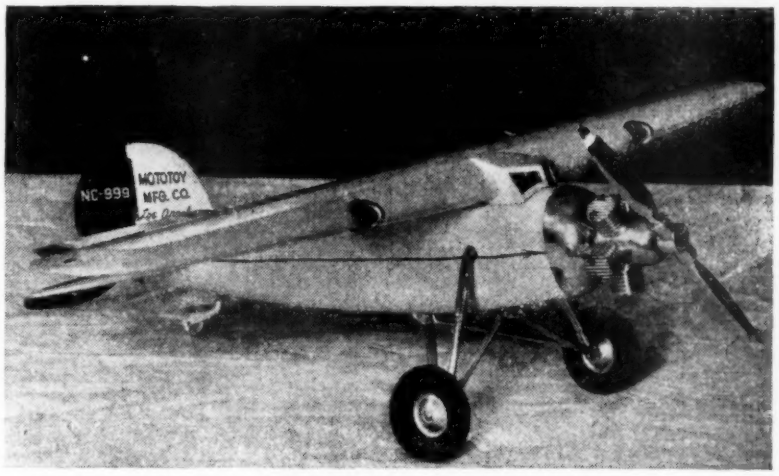
With the straw completely macerated and in a pulpy condition, more mechanical working is done by the water-buffalo and the resulting pulp is washed. The washing is very primitive. The material is placed in a cotton bag and washed by a swishing motion in the running water of a stream. The lime is completely washed out, and then the water is squeezed out of the bag. A homogeneous mass of pulp remains.

The pulp is now ready to be made into paper sheets. Mixed with fresh water, the pulp is dumped into a trough about one and a half feet wide by three and a half feet deep. It is at

(*Concluded on page* 54)

A New Motive Power for Model Airplanes

by G. B. BURTNETT



A view of the completed flying model with the new power plant installed. The fuel is introduced into an opening at the rear of the fuselage.

WHILE traveling by aerial transport, three years ago, Fred S. McFarland, retired theatrical producer, wondered why someone had not made a pocket sized radial engine to power model airplanes.

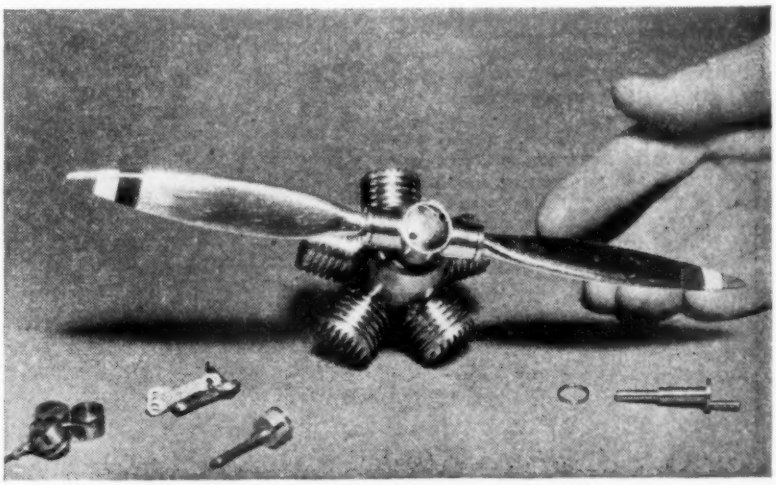
As he watched the huge radials of the transport pull his carrier through the air, he conceived the idea of doing away with rubber bands and clockwork mechanisms for toy planes. Laboring during those three years, McFarland has recently given public exhibitions of a miniature aircraft engine that performs just as the big radials do.

The secret is a fuel in stick form which is ignited, sealed in a chamber and supplies energy to a three or five cylinder engine. The power chamber runs the entire length of the fuselage of the model plane access being given where it protrudes under the tail surfaces. A valve with a quarter turn is easily opened, a stick of ignited fuel inserted, the valve closed and the engine begins to spin.

In less than two seconds after insertion of the fuel stick, the propeller reaches 2500 r.p.m. With the controls set for flight the plane is released, on the ground, and with a short run takes off into the air.

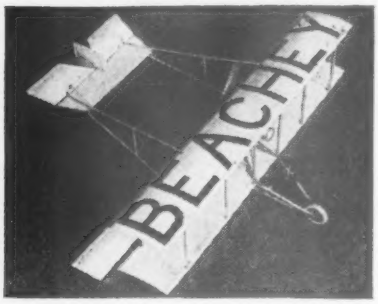
The special fuel is patented. It is nine inches long and one half inch in diameter. The engine developed for the first plane, a true scale Lockheed Vega, is of five cylinders. It has a three-eighths inch bore, one-quarter inch stroke and weighs complete with fuel tube, ready for installation in any model plane, only eight ounces.

The propeller is of duraluminum as is the engine. A steel crankshaft, brass piston rings and connecting rods are used in the engine which has a diameter of two and a half inches. It develops approximately one-twenty-fifth horsepower at 2500 r.p.m.



Here we have the completed motor and propeller assembled together with several of the motor parts. Note the extremely small size of the plant.

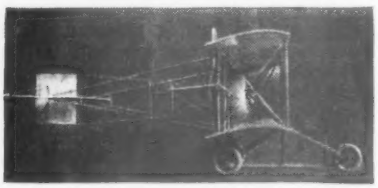
A Curtiss Pusher Model



Here's a replica of the Beachy Curtiss "Tripod."

EARL F. ALLRED, 4114 Arlington St., Chicago, Ill., makes a direct appeal to us with his model of Beachey's Curtiss pusher. This was a famous stunt plane in its day and Beachey's daring maneuvers with the ship were not far behind those of today's stunt flyers. He had a marvelous technique, although the variety of the stunts was necessarily limited.

This model is made with great attention to detail, even to the Monosoupape Gnome engine mounted within the drag ring. As this ship flew in 1912, it will be seen that the drag-ring idea is at least 21 years old and perhaps older. Many congratulations to Mr. Allred.



Side elevation of the Curtiss model.

What Do You Think of This

FOR you fellows having cameras, here's a good way to get unique effects by double photography. F. Sherman Mills, Mississippi State College shows himself standing by his model so that at first glance you would think it was a full size machine.

A photograph was taken of the model ship against a background that would not betray the size of the model and then a photograph of Mr. Mills was clipped out and leaned up against the model, care being taken to keep both light and shadow off the picture. The assembly was then photographed from a distance.

This picture is cleverly faked.

Reasons Why Your Model Doesn't Fly

by RALPH PRITCHARD

IT IS always a disappointment when, after having worked for three or four nights on a model, it refuses to perform properly. Many good models are discarded because it is thought that if they don't fly at first, they never will. This is untrue as we shall soon see.

There are two types of models that we should naturally consider, the non-scale, and flying-scale type. There is a difference between the expected performance of the two. From a flying-scale model we expect merely a good flight of about 15-30 seconds with an acceptable landing at the end. Some flying scales will average more than this but generally they do not conform much to scale. From a flying model we expect maximum performance—not seconds but minutes, the time ranging in accordance with their size and weight.

The reasons for either type of model refusing to fly can be traced back to the time when the first longerons are pinned to the drawing. As this is true we will now reconstruct our model from that point to see just why it doesn't perform properly.

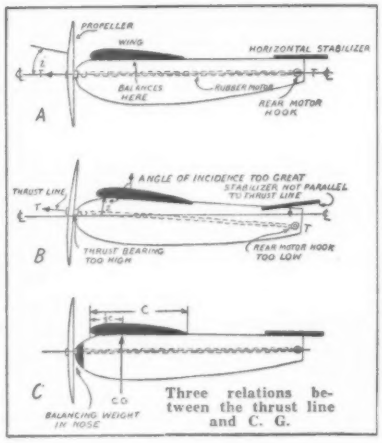
Balsa wood is very delicate. It warps easily and is also very easy to break. It is absolutely necessary to use good Grade A straight-grained, firm balsa and not the cheap flimsy cotton-soft balsa that many companies sell. Get your wood from a reputable company and you will not have trouble.

Unless your wood is of the straight-grained firm type it will not hold its shape when pinned down on the drawing. In order to keep it from warping it will be necessary to put in numerous cross braces which are just what we want to get away from to keep weight down to the minimum. Warping of wood before or after it is papered, of course, changes the shape of the fuselage.

In the case of a scale model, it doesn't then look much like a scale model and in the case of either type, it changes the line of thrust. This is probably the reason why many of your models do not fly. The changing of the line of thrust, from that for which the plans call, changes the balance of the whole ship and in many cases the ship absolutely will not fly unless it is corrected.

Changing the line of thrust naturally changes the incidence of the wings and tail and the ship will either stall or dive. First, it is necessary to build your fuselage sides accurately and without warp and to join them so that the prop will pull true through the center from the top view.

Another thing, a wee point that is generally overlooked when the plane is first started, is the position of the rear motor-hook. Drawings always call for a certain location of the hook. Due to carelessness you sometimes change it and place it either too high or too low in reference to drawing specifications. This again changes the line of thrust and can cause all kinds of trouble, such as diving and stalling. Our second rule then, is to see that we place our rear motor-hook where it belongs or, if the plane has a motor stick, make sure that the bulkhead where the stick rests is cut as it is supposed to be thus giving the stick the right angle.



Three relations between the thrust line and C. G.

In conjunction with these rules, perhaps a simple theory of flight ought to be given. The motor is pulling parallel to the ground and at right angles to the attraction of gravity. This is the imaginary line of thrust and it generally coincides with the centerline of the ship. This part of the plane then is parallel to the ground, the motor pulling straight ahead.

As an airplane is in reality a dart with a prolonged flight, we naturally have a tail to keep the rear section up. Although this is not always true, the tail surfaces—stabilizer and elevator,—should be absolutely parallel to the line of thrust. Therefore, the tail has no other action than to keep the body going along this imaginary line which the propeller is creating. The tail is large enough to "blanket" out the air created by the propeller and keep it in the center of that force and also from spinning the body whether the body is going up or down.

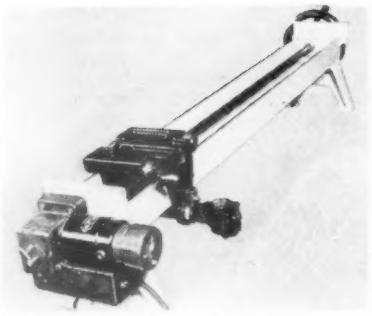
So far, we just have a powered dart which has no means of support other than the thrust created by the propeller which is only able to move it through the air on a rapid downward arc. But, if we find the center of balance and then add some supporting surface, we will be able to elongate the path of this projectile to such an extent that it will not drop but go up. This is, of course, accomplished by the wing balance.

The wing must be large enough to support the "dart" yet not so large

(*Concluded on page* 52)

What the Industry is Doing

Latest bulletins from the airplane, engine, equipment manufacturers and dealers boiled down into a nutshell. Contributions to this department are invited.



The Oxweld Straight-Line Cutting Machine with a cutting speed of 33 inches per minute.

AUTOMATIC WIND TEES are being produced by Arthur M. Wilhelm, Randolph, N. Y. These tees are 23 feet long and are so arranged that they indicate the wind direction when the wind is above 5 m.p.h. and the runway direction when the wind is less than 5 m.p.h. They are lighted at night and their bright orange color gives them good visibility in daylight.

A FLEET of all-metal low-wing Wasp powered P-26A Boeing fighters have taken to the air in Seattle, Wash. They are reputed to be the fastest Boeing pursuiters yet built although performance data is not yet available. They are designed to carry two machine guns and bombs, if desired.

SIR HUBERT WILKINS, noted explorer and scientist, has had a special airplane movie camera made for him by Bell & Howell Company, 1801 Larchmont Ave., Chicago, Ill. This camera will make a continuous map of the 3,000 mile dash soon to be made across the south polar cap, passing directly over the South Pole. Single pictures will be taken every six seconds, and then will be assembled into a strip map.

SEVERSKY AIRCRAFT CORPORATION, 570 Lexington Ave., New York City, has recently released a neat folder describing the Seversky amphibian which established a world's record of 180.3 m.p.h. for amphibians.

GENERAL MOTORS CORPORATION, New York City, announce that the Eastern Air Transport, Inc., the Transcontinental and Western Air, Inc., and the Western Air Express, Inc., all well known airlines, have been brought under General Motors control. The General Motors Corporation also owns a substantial interest in the Douglas airplane manufacturing plant, Santa Monica, Calif., and its subsidiary, the Northrop airplane manufacturing plant, Burbank, Calif.

A Cletrac equipped with a bucket well adapted to airport construction.

THE FOKKER WORKS, Amsterdam, Holland, have just announced the first high-speed multi-engined passenger transport plane built in Europe. It is powered by three American built, 640 h.p. Wright Cyclone engines which have given the plane a high-speed of 186 m.p.h. It carries four tons of useful load made up of 12 passengers, a crew of three and almost a ton of mail or cargo.

UNITED AIR LINES tell us that the sixty "247" monoplanes now in service, are covering approximately 47,600 miles every 24 hours.

THE AUTONATOR is a recently developed device that provides 110 volts A. C. for airplane service. The A. C. thus generated, without drain on a storage battery, is an economical and reliable source of current for operating A. C. airplane radios, searchlights, neon signs or any other apparatus requiring 110 volts A. C. It is driven from the engine by a belt or by a windmill and is available in six sizes, ranging from 50 to 450 watts output. It is made by the Autonator Laboratories, Inc., 8440 South Chicago Ave., Chicago, Ill.

BYRD'S CONDOR, to be used on the second Antarctic expedition, has just been tested with its floats. Loaded to a maximum of 17,800 pounds, the Condor left the water in 18 seconds.

THE STINSON MODEL "A" AIRLINER, a new high-speed transport with seats for 8 passengers and 2 pilots, is under construction by the Stinson Aircraft Corporatios. Three tractor engines will be used.

THE BOEING AIRPLANE COMPANY, Seattle, Wash., reports that it will have used approximately 62,000,000 duralumin rivets for the all-metal ships built at its plant before New Year's day.

A NEW CUTTING MACHINE, known as the Oxweld Straight-line Cutting Machine, has been added to the line produced by the Linde Air Products Company, 205 E. 42nd St., New York City. It has a linear speed up to 33 inches per minute, giving a straight steady cut and it can also be used for trimming or beveling plate. This machine is light enough to be portable and should be of interest to airplane manufacturers and repair shops.

ELECTRICAL RESEARCH PRODUCTS, 195 Broadway, New York City, has completed its first course in high-speed camera instruction. The instruction has covered the use of the Western Electric Cine-Timer, the ultra-high-speed camera capable of photographing 2,000 images per second and of recording time in thousandths of a second. This should be of interest to those who must accurately time races, maneuvers or airplane flight tests.

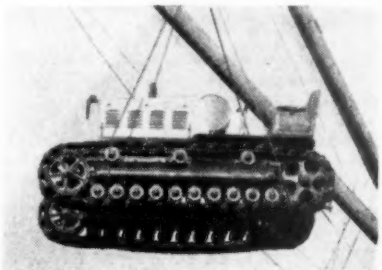
The Dutch Fokker transport powered with American built Wright Cyclone engines.

THE DEPARTMENT OF COMMERCE, Aeronautics Branch, states that 1,065 airplanes were produced in the first nine month of 1933. This is a slight increase over the production of 1932. Of this number, there were 410 monoplanes, 135 biplanes and 7 Autogiros. The 552 ships produced for civilian service included 390 ships built by large manufacturers on a large scale and 162 ships built by small manufacturers or individuals producing only one or two planes each.

A CLETRAC CRAWLER TRACTOR, built by The Cleveland Tractor Company, Cleveland, Ohio, has been loaded on the Steamer Jacob Ruppert of the Second Byrd Antarctic Expedition. This is the second time that a Cletrac has gone into the frigid zone, for this make of tractor was also used by Sir Hubert Wilkins in his expedition of 1929.

EASTERN AIR TRANSPORT has equipped one of its Curtiss Condors with two sleeping berths designed and installed by the president of the company. These berths are 6 feet 5 inches long and 2 feet 4 inches wide and have all of the standard railroad sleeper equipment such as sheets, blankets, call buttons, clothes nets, clothes hangers and individual ventilators. Capt. Rickenbacker made the first trip in one of the berths.

THE DEPARTMENT OF COMMERCE states that there were only two fatal accidents in the first six months of 1933 and there were



The Cletrac tractor of the Byrd expedition being lifted on the "Jacob Ruppert."

38,321,196 passenger miles flown per fatal accident. This is a record that the railroads should envy.

THE TEXAS COMPANY has closed a year's contract with the Transcontinental and Western Air for supplying that airline with gasoline and lubricating oil.

CLARENCE L. CLABAUGH has resigned as vice-president of North Shore Airways, Curtiss-Reynolds Airport, Glenview, Ill. J. G. Boess was elected to fill the vacancy.

RADIO COURSE INDICATORS, recently developed by the Westinghouse Electric and Manufacturing Company, remove the necessity for the pilot listening to the radio beacon tone signals. The indicator is similar to an auto dash ammeter so that the signals are read visually.

THE ZMC ALL-METAL AIRSHIP has shown such excellent performance that the Navy contemplates the construction of a similar all-metal airship built to the size of the Los Angeles. All that the Navy lacks for this purpose is money, but it is hoped that a sufficient appropriation will be voted by Congress.

MAJOR ERNST UDET, the stunt pilot, has purchased a Curtiss Hawk single-place pursuit biplane for his acrobatic work. It is powered by a 700 h.p. Wright Cyclone engine and develops a top speed of 206 m.p.h. with a diving speed above 360 m.p.h.

MEXICAN PILOTS flew six Kinner powered Fleet planes from Buffalo, N. Y. to Mexico City. They will be used as training planes for the aviation branch of the Mexican Army.

THE BOEING SCHOOL OF AERONAUTICS, Oakland, Calif., has issued a 36-page booklet that discusses the matter of aeronautical occupations in an interesting manner. It lists all of the known jobs offered by aviation, the duties and requirements.

AIR RACES are apparently no longer an attraction, for little money was made among the major meets. The National Charity Air Pageant, held at Roosevelt Field went into bankruptcy with a deficit of $40,368.

A KANSAS DESOTO-PLYMOUTH DEALER has a private plane with which he keeps in touch with the DeSoto factory in Detroit, Mich., or with this ship he can talk a prospect into a DeSoto sale anywhere within a 75 mile radius from his store.

END.

Airships

(*Continued from page 30*)

stresses, the longitudinals are progressively adjusted and recalculated until correct.

For some time, the diagonals caused difficulties. To omit them entirely was clearly incorrect, and to use shear methods instead of bending moments also led to inaccuracies. Professor Wm. Hovgaard, American, found a solution, whereby the diagonals are made a supplement to the longitudinals and the two elements calculated together. His method has been adopted both in the U. S. A. and Great Britain.

For the transverse frames according to the methods used, the aerodynamic forces are of minor importance. Here one deals with dead loads of structure, machinery, equipment, fuel, passengers, and crew, also with the supporting forces of the gas. Even so, the problem is not simple because this simple frame is also indeterminate; however, the elements are fewer, the redundancy not excessive, and aid is available also from the symmetry of conditions.

The classic authority on the subject is Hilda M. Lyon of the Cardington staff, who has written a thorough and competent paper on the stresses in transverse frames—likewise a R38 Award paper. This author admits freely that her solution has reference to the limited conditions assumed only and that there are forces originating in the longitudinals, or from aerodynamic forces passing through them into the transverse frames, but she has no means to evaluate these forces and therefore no means to figure their effects on the frames.

The practical designers have thus placed the three sets of elements into two groups, figuring the direct effects on each group separately, but having no definite or reasonably accurate method to find the interaction between the two groups. The omission is obviously a very serious matter, and to prove this it is sufficient to refer to the reader's own common sense.

Suppose he were to have a small model of an airship frame, were to hold this between his hands, and bend it over his knees. His hands and his knees thus represent aerodynamic forces. One cannot escape the conviction that the bending action will compress the frames in a transverse direction, will flatten them out into an elliptic shape. This clearly means supplementary forces on the transverse frames, and, by proportion, very heavy ones.

One may visualise an airship suddenly attacked by violent wind squalls and the bending caused thereby—most assuredly the secondary dynamic effects on the transverse frames are going to be more severe than the primary ones from loads only. And yet one has made no definite provision for these effects for the primitive reason that one does not know how to figure them. Is it for this reason, possibly, that so many good men have been sent to their deaths?

In the two design papers referred to—one of American and the other of British origin—the necessity of separate treatment has been admitted. It is also implied in the Lyon paper. We should then expect that the authorities check up on a theory, which is admittedly incomplete. We should expect the designers to ascertain the actual stresses in the transverse frames of completed ships during conditions of actual navigation.

On the German built 2R3, now the Los Angeles, extensive tests were made in 1920—see reports 324 and 325 of the United States Air Service, C. P. Burgess, editor of the material pertaining to forces, stresses, and strains. During these tests no less than 35 strain gages were placed to find out in what manner the ship was affected by aerodynamic forces and actual stresses compared with those calculated.

So completely absorbed were the engineers of these tests, in the relation between wind forces and the stresses in the longitudinals, that they applied all their instruments to these—and to these only—if the report as published is really complete. There was no check on the transverse frames, and to this day one does not know what increment to allow in these for the forces coming through from the longitudinals. Were these forces considered in the Akron?

END.

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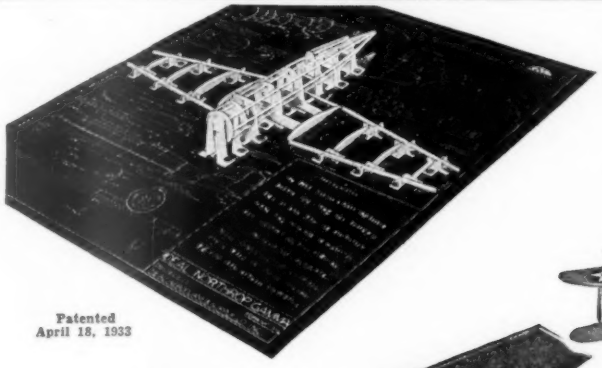
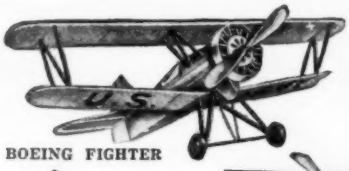


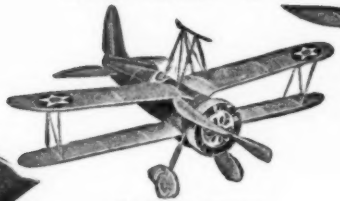
Patented April 18, 1933

Pick Yours from these 10 Models!

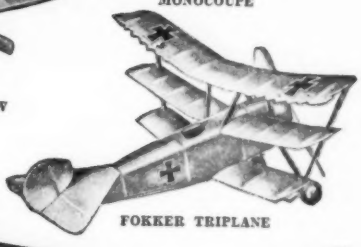


BOEING FIGHTER

MONOCOUPE

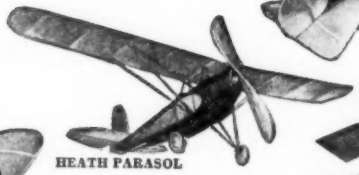


CURTISS SPARROW HAWK

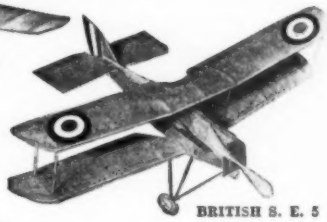


FOKKER TRIPLANE

BELLANCA MONOPLANE

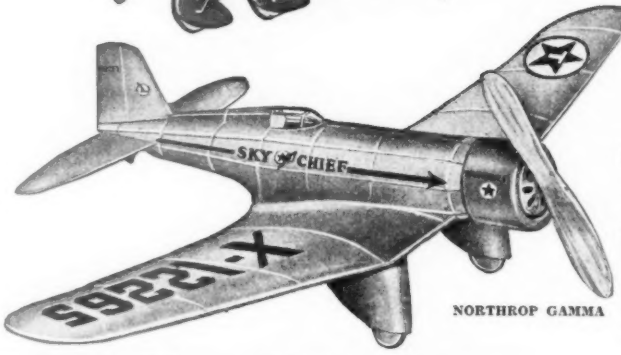


HEATH PARASOL

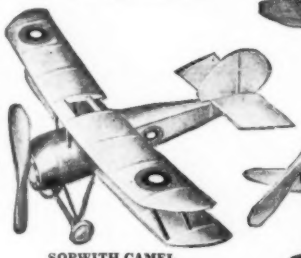


BRITISH S. E. 5

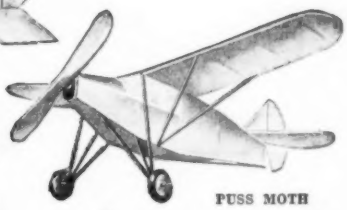
12 and 15 inch Flying Models



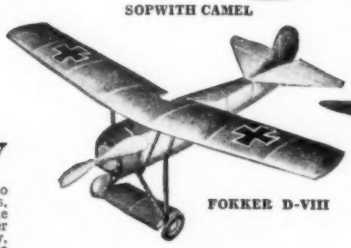
NORTHROP GAMMA



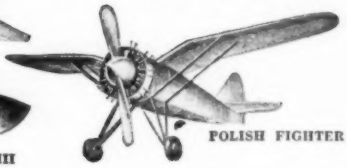
SOPWITH CAMEL



PUSS MOTH



FOKKER D-VIII



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Every Model is full-fuselage type, with constructed body, cambered wings, shock-proof landing gear, carved balsa prop, stamped motor plate and other fine features. Everyone Guaranteed to Fly. Kits contain everything, including full-size Plan and Instructions. Pick yours from the Models shown above—Your Model Airplane money cannot buy greater value.

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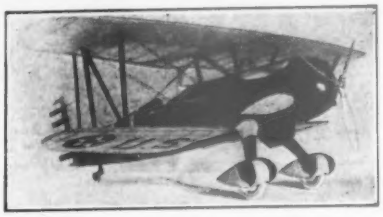
Curtiss Army Hawk P6E



24" Span, Weight 2¼ oz., Flies 800 Feet

The strongest and most perfect model of the P6E on the market, has squadron insignia on pants and fuselage, metal exhaust pipes, aluminum wheels, 2 color dopes, all parts printed on balsa, printed instrument board, semi scale, Fibre prop. Const. Set Complete, Postpaid.....$ 2.50

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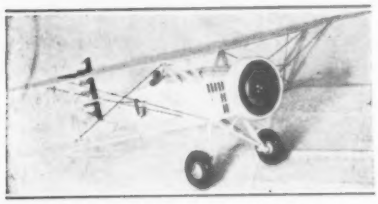

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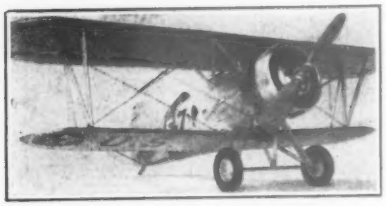

22½" Span, Weight 2¼ oz., Flies 750 Feet

Set contains 3" celluloid motor, aluminum drag ring and motor plate, ribs and formers printed on balsa, celluloid wheels, silver discs, wing, rudder, Army and fuselage insignia, semi-finished prop., Yellow and silver dope, glue, drawing and all materials. Const. Set, P.P.....$ 2.95
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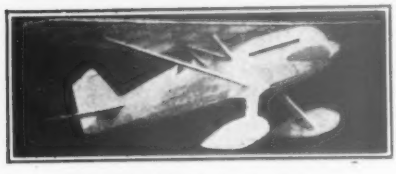

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Model Doesn't Fly

(*Continued from page 48*)

that it will over lift. This wing is placed at a slight positive angle to the line of thrust, usually about 3°, which gives the required lift.

But, if this angle of incidence is changed, if it is raised too much, the plane will continually stall because the wing is lifting more than it was intended to carry. Therefore, if you find your plane continually stalling, the first thing to look for is the angle of incidence. There are all ways of making it, but in most cases there is only one remedy.

You may have put more in than the plans call for; your body may have warped, causing the propeller to pull up; you may have put the hole in the nose plug too high or low; the rear hook may be placed wrong or you may have glued your tail on so that it causes the wind of the prop to throw the tail down.

These are all easily fixed, once you know just what the trouble is. It takes a real close diagnosis by the builder to tell which is the cause. This can be done by watching the performance of the ship and looking along its lines while held or set in flying position. If the body has become warped, causing the plane to misbehave, it is a good idea to build another. It costs very little, you get practical experience and, of course, build a much better body.

Are you one of those who correct a plane with a stalling tendency by an overdose of lead? I do not mean using lead legitimately for balance, such as placing enough weight in the nose of your models so that they will glide properly, but adding excessive weight to correct errors that should be corrected by other means. The ship flies properly when wound but falls like a rock when unwound. If you are one of those then you are unnecessarily shortening the life of your models because they hit hard in those instances and break easily.

END.

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Standard Aeronautical Model Supply
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Q & A

(*Continued from page 34*)

than at the rated speed? In other words, does it shorten the life of an engine to slightly overspeed it?

Answer:—YES. Every increase in the r.p.m. also increases the rubbing speed of the pistons and similar rubbing parts. As this wearing effect, due to the rubbing velocity, increases as the square of the velocity, it is possible to enormously increase the wear and shorten the life with a comparatively small increase in the speed.

* * *

QUESTION:—A. D. Nelson, Portsmouth, Ohio. *I have lost my college books and don't feel like buying more just to find out how to work out these simple problems. How do you extract the square root and the cube root of numbers by means of logarithms?*

Answer:—EASY. To get the square root, divide the logarithm of that number by 2.0. To get the cube root, divide the logarithm of the number by 3.0. After making these divisions, refer to the table and find the corresponding roots.

* * *

QUESTION:—Eber Morely, Independence, Kas. *What is meant by "negative overhang?" I saw this expression used in a book and cannot understand it.*

Answer:—WHEN the lower wing is longer than the upper wing, then the overhang is said to be negative." There are quite a few ships being built this way in Europe. When the upper wing is longer than the lower wing, then the overhang is "positive."

* * *

QUESTION:—Orville Settle, Boston, Mass. *Does a parachute jumper descend at a constant speed, or does the speed increase as long as the jumper falls? We have an argument on this and are asking you to settle it.*

Answer:—IF THE parachute jumper were falling in a vacuum, his speed would increase about 32.16 feet every second that he fell. If he were falling in uniform air, or air that had a constant density, then his speed would increase until the air resistance became equal to his weight and he then would proceed downwards at a uniform velocity.

But, under practical conditions, he is doing neither of these things, for the air density increases every foot of his fall. The rapidly increasing density, as he nears the ground, slows him up so that the last few hundred feet are covered at a much slower speed than at the time when he bailed out.

Summing up the conditions, we see that the speed of the chute is variable, starting in fast and slowing up as sea-level is reached. It is evident, that the chute would be of little account on high mountainous country.

END.

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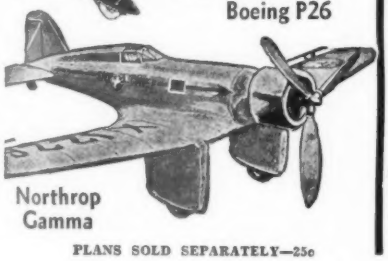
Boeing P26



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Rice Paper

(*Continued from page 47*)

this point in the manufacture that skilled labor is required.

The paper maker stands beside the trough, sheltered from the wind by straw mats. His tool consists of a fine-mesh sieve, a little smaller than the inside of the trough. Generally this sieve is divided into three sections.

He dips the sieve into the watery pulp until a thin layer of pulp covers the bottom of the sieve. With a quick motion of his arms, he raises the sieve and allows the excess water to run off. The sieve is inverted over a pile at his side, and the thin layers of pulp are deposited. This process continues till the trough is empty.

The separate piles of paper are then placed in a crude vise and the water is pressed out. The piles are now taken to sheltered fields and women separate the layers of paper. The sheets are laid on the grass to dry in the sun and when thoroughly dry they are again stacked into bundles, the edges are dressed down and the product is set aside, ready for market.

Bamboo and mulberry twigs go through a similar process, but due to their tougher consistency, much more time is required. As much as six to eight months is necessary to fully decompose certain forms of bamboo. This paper is much stronger, however, and is much in demand for domestic purposes, such as the covering of walls of houses and for paper umbrellas.

It will be of especial interest to model makers that it is comparatively difficult to obtain real rice paper in this country. Most of the so-called rice paper is really bamboo paper.

SPECIAL NOTICE

At last the United States is to have a national chain of flying clubs. After four years of actual research and experimenting a proven flying club plan has been worked out by one of this country's outstanding flying club organizers and operators

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Piggy-Piggy

(*Continued from page 20*)

"damns" and one or two "what-in-the — — —," wanted to know what business we had to land our — — — airyplane in his — — — hog pasture.

"My dear sir—" began Mr. Jackson, by way of explanation.

"Don't you 'My-dear-sir' me! If that thing will run you get in it an' get outa here as fast as you can." That gentleman meant business and we lost no time in taking his advice.

Mr. Jackson crawled back into his cockpit, Tommy swung the prop on the Hisso and he revved up the motor. This elicited more "woofs" and more running on the part of the piggies.

It was but a few minutes, flying time, into to Crosby. We circled the town, located a level pasture nearby and set down. Mr. Jackson idled the motor until it cooled enough for him to cut the switches after which the three of us went into town.

"Say, Tommy, there's no passengers around so I'd like to use the ship a little while. I'll be back in an hour." Tommy was half owner.

The beer-loving Mr. Jackson was gone about two hours. Tommy was just beginning to get a bit worried when suddenly we heard the roar of the Hisso over town and about twenty minutes later the door of our room opened and in walked the Hero. And what a sight he was! One cheek was swollen and turning purple, a red welt ran half the breadth of his forehead, and across his chin was a ragged, deep scratch. At sight of him Tommy let out a whoop.

"Now, boys, don' get exshided," soothed Mr. Jackson, grabbing at a bed post which eluded his grasp. "Everything ish all right."

Tommy stopped laughing and turned kind of pale around the gills and jumped up from off the bed. "What d'ya mean 'everything is all right'?" he demanded suspiciously. "Did you crack up that ship?"

"Well, no, but you see thash sowsh—"

"What in the blazes are you talking about?"

"A SOWSH!" roared Mr. Jackson, his face aploplectic. "One of them shings with a curly tail tha——"

"You mean a SOW!"

"Shure! you see—"

Well, we finally got the story. It seems that after leaving us at the field, Mr. Jackson had flown out to the farm where, true to her promise, the farmer's daughter had the piggies all bottled up in one end of the pasture. Mr. Jackson had set the ship down, imbibed a few bottles of beer, and then had taken his new girl friend for a ride. By some miracle they had managed to get back into the pasture without hitting a hog or two.

He helped the girl round up the poor piggies once more, swung the prop on the Hisso and had staggered around and crawled into the rear cockpit. Then the trouble had started!

A monstrous Poland-China sow, weighing a full five hundred pounds (according to Mr. Jackson) had rebelled at the idea of being herded around so much in one day and had bolted away from the herd to go lumbering down along the fence. To Mr. Jackson's mind this was nothing short of a catastrophe. Never would he dare to take off so long as that sow was out there. No sirree, not Mr. Jackson! But he would go after her with the ship and teach that lady a lesson.

Mr. Jackson was as good as his word. He slammed open the throttle on the Hisso and tore out down the pasture in hot pursuit of the fast moving porker, which, though fleet of foot, was outclassed from the beginning. Half way down the field, Mr. Jackson, sailing along under full steam, caught up with his quarry.

The tip of the right lower wing slammed into the hind quarters of the lumbering animal and the sow went rolling. The wing dug into the ground, whipped the ship into a nasty ground loop and Mr. Jackson's head banged into the instrument board. Damage: One surprised and pained hog, one crumpled lower wing tip, and various and sundry bruises and scratches.

Mr. Jackson finished his tale, staggered over to the bed and flopped down. Tommy and I hurried out to the field to examine the damage and to get our beer.

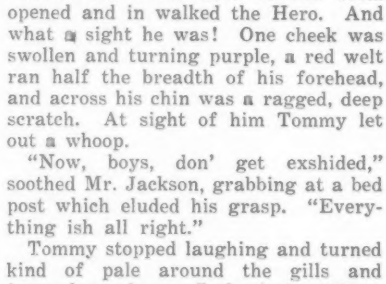
Arriving, we found that someone had got away with our share of the beverage before we arrived, and after surveying the ruins, resolved to return to the house and razz our sybarite before going to supper.

"Hey, wake up and let's get some chow," said Tommy, shaking Piggy.

"It was that SOWSH," was his one and only reply.

"Oh, shut up," shouted Tommy, "This is the last time I'll ever deal with a sun-kissed pickled barnstormer."

END.



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Aero Lessons

(*Continued from page 36*)

bullet in flight and probably represent air that is compressed to extreme density. The turbulence (T) is not visible on such photos unless smoke trails are used with the air.

This sudden jump in resistance at very high speeds is illustrated by the graph in Fig. 10. Here we see that the exponent of resistance velocity remains fairly constant up to a velocity of 600 feet per second, but for higher velocities the resistance jumps up suddenly along (A-B) until it reaches a value of more than twice the original value at a sound velocity of 1080 feet per second, as indicated at (B). In other words, the exponent of V^2 is increased to about $V^{4.5}$. It reaches a maximum at (C), or about 1250 feet per second, decreases slightly and then remains fairly constant along (D-E). Therefore, in the neighborhood of the velocity of sound, or the velocity of a high-power rifle bullet, the resistance formula reads:

$$R = K' \times A \times V^{4.5}$$

Where (K') is the new resistance coefficient determined in the ultra-high-speed zone.

This region of resistance has not been very thoroughly explored and the figures given here are only approximately true. However, the coefficient of resistance and the velocity exponent are both very much higher than at the present normal speeds. In other words, if our speed is above 600 feet per second, we are certain to encounter a sudden and astonishing increase in the resistance.

This fact is illustrated very clearly in everyday aviation experience. For example, when the tips of propeller blades travel at a speed of 1,000 feet per second, or higher, there is a sudden increase in the blade resistance and an equally sudden drop in the efficiency of the propeller.

Now, while the tip velocity is ordinarily computed in respect to some fixed stationary point, its actual velocity in respect to the air is smaller than this due to the spiral flow of the air traveling with the propeller blade. Therefore, it is very likely that the relative air velocity in the case of the propeller, is nearer 600 feet per second than 1,000 at the time when the efficiency drops off.

Pursuing this matter, a little further, I will state that the velocity of sound is directly proportional to the density of the air, hence in the upper altitudes where the air density is decreased, the sound velocity also decreases. And with it, probably, comes a lower velocity at which this sudden increase in resistance takes place. Thus, if the exponent is 4.5 at a sound velocity of 1080 feet per second at sea-level, the same exponent will likely to be found at a lower speed when the altitude is increased.

END.

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Eight Citations

(*Continued from page 12*)

their Infantry and Artillery positions. Spandau lead drilled and tore its way into the ship, cutting it to ribbons. While Bernheimer did his best to keep out of the terrific stream of lead and tracers, Lieutenant Jordan swung his Lewises around on the scarf into action.

But before he could draw an accurate aim, Spandau lead found Jordan in the rear cockpit. But he was game to the core. Bernheimer had to get back with the valuable negatives. There were 36 negatives in his camera. They were of inestimable value; they might save as many thousands of American lives. What mattered if he was shot. The Corps had to have those photos.

So disregarding the body-racking pain and weakness caused by loss of blood, Jordan kept his machine guns yammering. Saw one Fokker after another dive down upon him and veer off before his withering fire. He didn't know if he shot them out of the battle skies or not—nothing mattered as long as he kept them off Bernheimer's tail. Nothing mattered to Jordan as long as Bernheimer could keep flying back homeward.

And it flashed through his mind that it was even more than Bernheimer's plane that he was defending. It was not one plane nor yet one man, but the safety of a whole division of infantry in the trenches.

* * *

ABOVE the photographic plane, a furious milling of planes, revving of motors and barking of machine guns was going on. Vickers crossed fire with Spandaus. A vicious determined duel to the death.

Then McClendon and Plummer were caught in a Fokker trap. Five Huns boxed them in. The Yank's ship, with guns sputtering ribbons of fire, rolled, and slid off freakishly. McClendon and Plummer went down to their deaths. Gallantly gave their lives to protect their buddies with the camera.

Babcock and Palmer dove after the Huns to save the photo plane from disaster. At its low altitude it was at the mercy of the Fokkers. Anti-aircraft guns released their thunderous heaven-tearing explosions.

The plane flown by Lieutenant Hitchcock went into a nose-dive at 2,500 meters. Burns, his observer, was shot dead. His body had slumped into the cockpit, jamming the control cables. Hitchcock worked desperately at rudder-bar and stick to regain control of his ship going down out of control. After a desperate effort he got the diving ship under control—a scant hundred feet from the ground and barely succeeded in landing safely.

And, by now Bernheimer and Jordan, with only Babcock and Palmer to protect them, raced and fought for their lives. Through a leaden hail of death they banked and zoomed slipped and dove. In a maddening haze of tracer smoke they drove their planes. One must get back safely. One must do the utmost to live up to the letter of the Corps order. It seemed impossible now. The odds were too great.

But they were lads with exceptional courage and skill. In the breast of each pounded a true fighting heart. They flew and fought in a maddening furious turmoil of planes and mawing motors. Fought until they succeeded in driving the last menacing Fokker out of the sky. Then they brought their battle scarred observation planes home.

Observation? Who said an observation squadron couldn't fight and lick three times its number? The citation says they did and did it nobly. Read it for yourself. It is the most amazing citation ever written. One for eight men—every one a hero.

* * *

Note: War Department list gives 3 as deceased; individual award list gives 4 which includes Hitchcock not noted as deceased on this list.

"Louis G. Bernheimer, 1st Lieutenant, pilot; John W. Jordan, 2nd Lieutenant, 7th Field Art., observer; Roger W. Hitchcock, 2nd Lieutenant, pilot; James S. D. Burns (deceased), 2nd Lieut., 165th Inf., observer; Joel H. McClendon (deceased), 1st Lieutenant, pilot; Charles W. Plummer (deceased), 2nd Lieutenant, 101st Field Art., observer; Philip R. Babcock, 1st Lieutenant, pilot; Joseph A. Palmer, 2nd Lieutenant, 15th Field Art., observer.

All of these men were attached to the 88th Aero Squadron, Air Service.

For extraordinary heroism in action near Fismes, France, August 11, 1918. Under the protection of three pursuit planes, each carrying a pilot and an observer, Lieutenant Bernheimer and Jordan, in charge of a photo plane, carried out successfully a hazardous photographic mission over the enemy's lines to the River Aisne. The four American ships were attacked by twelve enemy battle planes. Lieut. Bernheimer, by coolly and skillfully maneuvering his ship, and Lieut. Jordan, by accurate operation of his machine gun, in spite of wounds in the shoulder and leg, aided materially in the victory which came to the American ships, and returned safely with 36 valuable photographs. The pursuit plane operated by Lieut. Hitchcock and Lieut. Burns was disabled while these two officers were fighting effectively. Lieut. Burns was mortally wounded and his body jammed the controls. After a headlong fall of 2,500 meters, Lieut. Hitchcock succeeded in regaining control of his plane and piloted it back to his airdrome. Lieut. McClendon and Plummer were shot down and killed after a vigorous combat with five of the enemy's planes. Lieut. Babcock and Palmer, by gallant and skillful fighting, aided in driving off the German planes and were materially responsible for the successful execution of the photographic mission."

* * *

And that is the strangest of all citations. It is the only one on record that simultaneously awarded the Distinguished Service Cross to eight men at one and the same time and for a single battle.

END.

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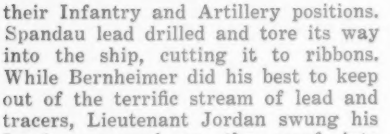

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Airy Chat

(*Continued from page 6*)

During the years 1927-1929, the engine builders were so busy selling and improving the commercial end of their business that the technical end was slighted. But, after three years or more of slack business, it would seem that the builders would again have their houses in order, ready to build a satisfactory product at a reasonable price.

* * *

AND the above paragraph brings to mind the fact that the aviation industry, from its very inception, has always been hampered by some sort of racketeering or incompetency. During the early years, and even to a limited extent today, aviation has been cursed by hordes of fake stock-salesmen, selling stock in fake or get-rich-quick aviation concerns. This, of course, discredited aviation in the minds of the investing public who at one time or another have been defrauded in such enterprises.

Further, aviation progress has also been impeded by freak legislation, by autocratic administrators of these obstructive laws, by poor merchandising methods, by self-appointed dictators operating from a purely selfish standpoint and general all around incompetency. If any industry needs the full application and support of the "new deal," it is certainly the aviation industry.

* * *

OUR Barter and Exchange customers, for a long time, were very very careful and painstakingly printed their names and addresses. In fact, we were able to read nearly every letter for a period of several months. But now they are slipping again. Once more they are scribbling their names and addresses so that we have a heck of a time trying to decipher them. So—please reform and start the printing idea again. This will help you as well as ourselves.

* * *

ITALY is certainly going into aviation in a big way. The Italians are producting a steady stream of new type airplanes and engines which, in the most part, are highly original designs. Signor Caproni is to be commended for his great originality and initiative.

* * *

FOR the past year, we have been receiving from four to eight manuscripts per day. This amounts to 100 or 200 stories per month that must be carefully read and routed. Of course, this takes a considerable amount of time and sometimes leads to embarrassing situations.

We wish to assure every author contributing to this magazine that his manuscript is taken up in turn and is disposed of with the greatest possible speed; but because of the long "waiting line" this frequently seems like a long time to an impatient author.

There is one omission, however, that causes a lot of delay. This is caused by the author's neglect in signing each manuscript with his name and address. Not being mind readers, we cannot return nor pay an author if we do not have his name. It is not sufficient to give your name and address on the letter accompanying the mss., for the letter is often separated from the story and filed. Please sign your name on every story that you send in and things will be a lot easier for everyone.

* * *

IN OUR next issue, we will print an article by an author who has spent a great deal of his time analyzing the cause of landing and take-off accidents. He thinks that he has found the reason for the sudden descent that sometimes takes place when near the ground and has proposed a remedy for this trouble. It has formerly been customary to blame such crackups on the student, but as the writer shows, the instructor is sometimes more to blame than the kiwi when the crackup occurs with a training ship.

* * *

HAD the World War lasted another six months, we would have seen a very fine fighter placed on the line by the United States. This design successfully passed the wind-tunnel tests just a little while before the armistice was signed and would have proved fully the equal in speed of many ships produced as late as 1930. It had an anti-drag ring, very similar to the Townend ring, the rigging was similar to the rigging of a present day biplane and it had the same general outlines of a modern fighter. We will run a description of this unknown soldier in the February issue

* * *

WE'VE made a change in the method of presenting our readers home-built ships, and have incorporated "What Our Readers Are Building" under a new lightplane section. Hope you will like it, and we also hope that we will receive enough photos to maintain it.

* * *

WHAT do you think of this? Our model department received over 4,000 requests for the full size drawings of the Boeing "247." This is certainly showing a lot of interest in the contest.

* * *

MORE and more, the Federal and the municipal governments are competing with private enterprises and loading the expenses upon the taxpayer. Starting aviation courses in the public high-schools, supported by the public purse, is the latest racket of the city school-boards.

So far as Airy Chat is informed, there are about fifteen high-school aviation courses organized in this country, extending from New York to California. At first, the writer rather sympathized with this movement, but after a careful investigation, he finally concluded that this sort of thing should be abolished. He fails to see why the taxpayer should spend money on a public trade-school education that interfere with privately conducted schools which are also taxpayers.

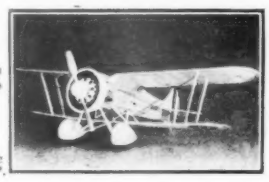
Any worthy boy, if possessed of a real ambition toward aeronautics, will always be able to find ways and means of paying his own tuition without leaning upon the public. At least, boys have done this in the past and it would add to their self-respect if they did it in the future.

* * *

AND, here's where I'll have to stop —not for a lack of comment but to prevent bumping into the advertisement below. But before parting from you fellows, this month, I just want to shoot one last word—don't forget that the contest closes on December 26, 1933. Better get in early than not get in at all. So long and best of luck.

—J. B. R.

B/J XF J-2



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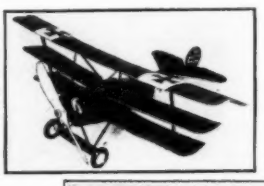

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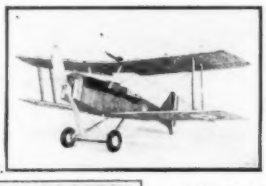

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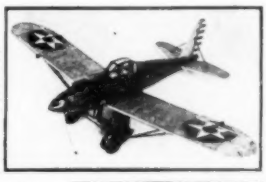

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1/16x1/4	14	for 5c
3/32x3/32	18	for 5c
1/8 x1/8	18	for 5c
1/8 x3/16	12	for 5c
1/8 x3/8	6	for 5c
1/8 x1/4	8	for 5c
3/16x3/16	8	for 5c
3/16x1/4	6	for 5c
3/16x3/8	5	for 5c
1/4 x1/4	6	for 5c
1/4 x3/8	4	for 5c
1/4 x1/2	3	for 5c
1/2 x1/2	2	for 5c

BALSA PROPELLER BLOCKS

3/8x 1/2x 5	8	for 5c
1/2x 3/4x 5	7	for 5c
1/2x 3/4x 6	6	for 5c
5/8x1 x 7	3	for 6c
3/4x1 x 8	2	for 6c
3/4x1 x 9	2	for 7c
3/4x1 1/4x10	2	for 9c
3/4x1 1/2x11	1	for 5c
3/4x1 1/4x12	1	for 5c

BLOCKS (Cont'd)

1 x1 1/2x12	1	for 7c
1 x1 1/2x15	1	for 9c
1 1/4x1 3/4x16	1	for 11c

18" BALSA SHEETS

1/64x2	4	for 10c
1/32x2	7	for 10c
1/16x2	6	for 10c
3/32x2	5	for 10c
1/8 x2	4	for 10c
3/16x2	3	for 10c
1/4 x2	3	for 12c
1/2 x2	2	for 11c

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1" x2"	1	for 12c
1" x3"	1	for 15c
1" x6"	1	for 25c
1 1/2"x1 1/2"	1	for 20c
2" x2"	1	for 20c
2" x3"	1	for 25c
2" x6"	1	for 45c
5" x6"	1	for 75c

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Aviation Engines

(*Continued from page 22*)

can manufacturers in the development of engines of one-thousand or more horsepower, and while there is no denying the need for conducting such developments here, there is lack of sufficient evidence to intelligently predict activities of this character in the immediate future.

Although the twelve-cylinder Vee type engine will undoubtedly continue as first choice in liquid-cooled designs delivering up to eight-hundred horsepower, we shall occasionally find such forms producing as high as one-thousand horsepower by means of supercharging. Of all possible forms in which large liquid-cooled engines may be constructed, the eighteen-cylinder W type seems to possess the greatest advantages.

For the reader who is not familiar with such a cylinder arrangement, let us explain that it consists of three rows of six-cylinders normally disposed with an angle of forty degrees between the center and each outside row. This form has been adopted in several European designs, and was used by the author in the design of an eight-hundred horsepower unit for the Army Air Service about twelve years ago, this being the first, and I believe the only one of its type ever constructed in this country for aircraft purposes.

A form having an even better arrangement for eighteen cylinders; namely, one having eighty degrees between the center and two outer six-cylinder rows, was originated by the author, and its salient features decribed in an article appearing in "Aviation" on August 4, 1924. Two French engine manufacturers have since adopted this form, and while space will not permit any further comments concerning its outstanding features, there seems ample justification for the opinion that it will be adopted for the majority of future designs delivering from one-thousand to two-thousand horsepower.

THERE has been a gradual increase in the use of propeller reduction gears for aircraft engines during recent years, but one could not safely predict that the present ratio of engines so equipped will ever be greatly exceeded. No one desires to add to the cost and weight of an engine, and unless the gain in effective horsepower for its intended service is enough to warrant the use of gearing, the direct-drive engine will be preferred. Years ago, before fully reliable gear reductions were developed, the advocates of gearing would have you believe all aircraft engines should be so equipped. However, today, the uses are so well defined that most designs are prepared so they can be constructed either way.

It is needless to explain that propellers of fixed pitch show maximum efficiency at one speed, and this is usually the speed at which they normally operate. Moreover, with a variable pitch propeller, it is possible through control to secure the maximum useful power of the engine under all conditions. We will, therefore, see a steady increase in the use of variable controllable pitch propellers for all types of aircraft. Mechanical complications and manufacturing costs now limit the use to the more expensive airplanes, but it is expected in the not too distant future there will be simplified.

The reader who anticipated some amazing predictions at the beginning of this article may have found these comments on future design trends of no unusual interest, but, it must be remembered that they are based upon existing design knowledge, and one cannot be associated with this field of development for nearly twenty years without becoming a bit conservative in expressing his views. The dreaming prophet might picture the developments in the distant future in such a fantastic manner as to thoroughly grip one's interest, but of what value are predictions that will never become realities during the lifetime of this generation?

Unfortunately, in attempting to cover such an extensive subject within prescribed limits, it has been necessary to omit mention of several engine types which have some merit when adapted for special purposes. It is firmly believed, however, that none of the more important developments have escaped mention. If anything were to be added to the views regarding future developments, it would be that the principal trend is not so much to develop something radically new as to containue the refinement in those special fields showing the greatest potential possibilities.

END.

20" BOEING P-12-E

Photograph of the Boeing P-12-E Model

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Inventions

(*Continued from page* 18)

Inventions and Designs. The N. A. C. A. does not consider an invention until this subcommittee has looked it over and reported on it. On reaching the N. A. C. A., the invention is given very careful consideration. Correspondence is entered into directly with the inventor in order to determine fully the merit of his invention.

If it lacks merit or novelty or value to the Government, the inventor is so advised and reasons are fully set forth. Any models submitted by him are returned, and his ideas are not disclosed to the public. If the invention is found to have merit, however, it is favorably recommended to the Patents and Design Board which alone has jurisdiction to evaluate it and make an award for its use by the Government. In brief, then, your invention ultimately reaches the N. A. C. A. and unless you feel you have good reasons for so doing, it is quicker to submit it direct to the Patents and Design Board's chairman.

The invention, having been passed on favorably by the N. A. C. A., is passed on to this Board for the award to be made. It is this Board that is empowered by law to go the limit of $75,000 if, in its opinion, the idea submitted justifies such an expenditure. You may submit patented or unpatented inventions to the N. A. C. A. Indeed, even unpatentable inventions may be submitted.

In a communication received from Mr. Victory, N. A. C. A. secretary, the policy of the Committee toward inventors is expressed as follows:—

"The Government welcomes inventions and new ideas to improve aircraft irrespective of whether they are patented, unpatented or unpatentable. Although the greatest reward to an inventor is usually to be found in the marketing of his invention with the aircraft industry, it is possible, under the law, for the Aeronautical Patents and Design Board, on the favorable recommendation of the N. A. C. A., to make a cash award for a nonexclusive license for the government's use of an invention or design submitted."

All inventions and designs must be submitted to the N. A. C. A. in writing and be accompanied by descriptive matter sufficiently clear to present the idea. Models, with blue prints and engineering data are highly desirable and go a long way toward facilitating the work of appraising their value.

The proceedings of the Committee are informal during such deliberations. On request, in case an invention has had favorable recommendation from the director of aeronautical research, an inventor will be granted a hearing before the Committee before a final and adverse report is made.

INVENTIONS and designs are considered by the Committee only as to their technical merit, irrespective of whether they are patented or unpatented, although evidence of lack of novelty, according to the Committee's rules, may be taken into consideration. The Committee not only does not undertake to determine the validity of a patent, but it will not consider claims for alleged infringement of patent rights. These are matters that are entirely outside the scope of the Committee's functions.

The volume of inventions and designs submitted yearly to the N. A. C. A. is staggering. Since the year 1927, when the number received and passed upon reached the 1,000 mark, this volume has been steadily increasing. There is no point in misleading the reader into believing that he has anything but a hard row to hoe in trying to interest the Government in an invention.

A representative year, according to an annual report of the N. A. C. A., shows that of 1,000 inventions received, approximately 500 were found unworthy of favorable recommendation by the Patents and Design Board for the consideration of the Committee. These cases were disposed of by direct correspondence with the inventors. Of the remaining cases there were reports and recommendations prepared for the Board, only three of which were completely favorable and hence eligible for an award.

From this, the inventor can see just about where he stands. The chances are about 3 in 1,000 of an acceptance entailing a Government award within the prescribed $75,000 limit. The bright side of the picture is contained in the communication of Mr. Victory quoted above. Manufacturers, eager to win the eternal battles of industrial competition, are always on the alert for something new and not only accept more new devices than the Government does, but usually are willing to spend more money in their acquisition.

POPULAR AVIATION, continuing its examination into the matter presents herewith a few of the reasons why inventions are rejected, together with some pointers to the inventor.

One of the most frequent complaints made by those whose business it is to consider inventions is the lack of engineering or technical data accompanying the inventor's brain child.

In countless cases the inventor has failed not only to provide good working models of his device or design, but has left engineering data to be guessed at or filled in by laboratory workers.

If any merit is seen in the idea submitted, it is subjected to exhaustive tests, computations and experiments until its feasibility is determined. But the lack of sufficient data has undoubtedly militated against the inventor in many a case. He has made his case more difficult, but what is much more often the case, the lack of technical data develops into proof that the invention is a mere theory, untested and unsubstantiated by the inventor himself.

END.

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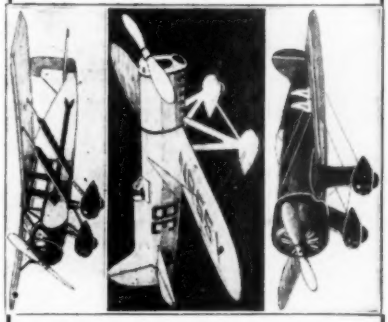

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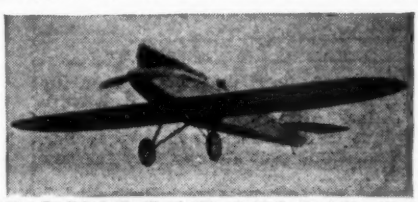

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4 ft. for Harley and Indian motors.....$ 4.50
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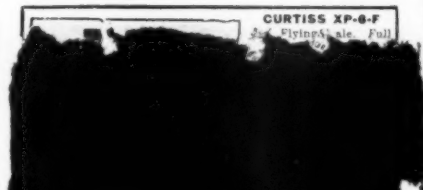

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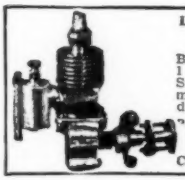

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1/8 x1/8,	26 5c	1/8 x2,	5....10c	⅝x1 x 8	....2c
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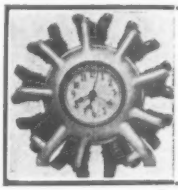

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Balsa 18" lengths		Clear Cement, 2 oz 10c
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1/8 x1/8.....25	for 5c	1 1/2" 4c
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Ballooning

(*Continued from page* 14)

scaled the peak with but a few scant feet to spare, and again whirled into the inky darkness beyond. To add to our worries, our ballast was getting low and we were obliged to conserve, lest we be forced to land before dawn. To attempt a landing in utter darkness in a howling gale among the mountain peaks would be suicide.

Again, our safety lay in altitude, and our ability to ride out the storm until the light of day would reveal some favorable landing territory. So we had no alternative but to sail along at an altitude of 4000 feet or higher until dawn. At about 5:00 A. M., the snow abated and as we emerged from the murky clouds, we scaled another mountain peak on close margin.

At the break of dawn, we looked straight down a rocky cliff some 4000 feet into a crescent-shaped valley. We were caught by a wind that whirled us along a crescent-shaped course with violent upward and downward surges, which undoubtedly would have destroyed any other type of aircraft. The balloon, at times, in the rapid changes of wind currents, assumed an elongated egg shape.

All of a sudden, we were whisked off at right angles between two mountain peaks whose slopes were heavily timbered. Just as suddenly, our drag rope caught in a tree top and held fast. The balloon came to a stop in the air with a sudden shearing snap. We were all thrown in a heap in the bottom of the basket. One member of the crew was hurled against the box which contained the four carrier pigeons. The sharp corner of the box cut through the heavy flying clothes and sheepskin boots and injured his shin bone severely.

When the drag rope brought the balloon to a sudden halt, the bag leaned over in the gale at an angle of 60 degrees with the basket. This crazy antic cost us more ballast in order to keep the balloon clear of the trees in its angry surges. Finally, the drag rope became untangled, and we sped on again in a burst of speed.

As we raced along over a long sweeping valley, the balloon shot earthwards, caught in a downward surge. We were losing altitude rapidly. More sand was spilled in feverish haste to keep aloft, as we were still over unfavorable landing. We scaled the mountains on the opposite side of this valley and then looked down upon the first signs of human habitation since the dreary hours of the night before. The mantle of snow spread upon the countryside, sparkled in myriads of crystal jewels.

A country road, and best of all a farm house near by. We decided to land, for we had quite enough thrills for one night. Operating the gas release valve, we descended gently in the lee of a protecting knoll, and then drifted to a safe landing near the farm house of Mr. and Mrs. Grubshaw, near Roseville, Pennsylvania, on the Pennsylvania-New York border, at 6:30 A. M.

After packing the deflated balloon into its basket, we released the carrier pigeons bearing messages to Lakehurst, giving our position of landing. These faithful little feathered messengers are often the only means of communicating with headquarters by stranded aviators, regardless of the distance or location in which the aircraft may have landed or become disabled. We were then invited to a most delightful country breakfast, as the guests of the Grubshaw household, and what a breakfast it was! The delightful hospitality of our host was heartily appreciated by four weary sailors of the sky.

Later, we were conveyed by auto to Elmira, New York, from whence we entrained for the return trip to Lakehurst, New Jersey, leaving the balloon to follow later by freight. Thus ended a most thrilling experience in night flying, and brought us to a keen realization of the lurking dangers which may have brought tragic death to many of our missing free balloon pilots.

END.

Potez 45

(*Continued from page* 14)

and a machine gun located at the rear of the observer's seat which possesses an exceptionally wide arc of fire. The leading characteristics of the plane are as follows:

SPECIFICATIONS

Wing span	42'-7"
Length	32'-8"
Height	10'-8"
Wing spread with wings folded	17'-6"
Total wing surface	285.5 sq. ft.
Engine—Salmson 250 MP, 1700 r.p.m.	

FULLY LOADED PERFORMANCE

Speed at sea level	111.75 m.p.h.
Speed at 6500 feet	106.6 m.p.h.
Climb to 6500 feet	4¾ minutes

END.

NEW! 6 ft. FLYING SCALE MONOCOUPE

Wingspan 72" length 43" wt. 12 oz. Colors, yellow & black

GUARANTEED TO FLY 500 ft.

Complete Kit $5.00 Shipping Charges Collect

CONTENTS OF KIT:

Finished drilled propeller. Finished drilled balsa wheels with brass bushings. Finished drilled nose plug with brass bushing. Finished drilled balsa cowling. Finished drilled balsa cowl front. Finished wire fittings. Semi-finished balsa pants. Tissue, rubber motor. All balsa strips cut to size. Large bottle banana oil, cement, and light-weight colored dope. Full size plans and explicit instructions.

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The publishers reserve the right to reject any or all notices that are not in accord with the policy of this magazine. Only trades or "swaps" will be permitted. For cash deals, buying or selling, refer to our Buyer's Directory. Readers are urged to use caution in arranging trades and references should be mutually exchanged.

AIRPLANES

AIRPLANE. Heath parasol wood fuselage, less motor; OX5 motor complete with propeller and radiator; 2 cylinder opposed motor, 30 h.p. with propeller; New Heath wing uncovered; Heath fuselage (wood) uncovered; New Pietenpol tail-group uncovered; Pair of 26 x 4 wheels, tires and tubes; Converted Chevrolet motor with propeller; New single and double-throw crankshaft for Lawrence; New Bennett-Samson propellers of all sizes. Will trade for Continental A-40 motor; Szekely 45; Szekely 30; Heath B-4; Aeronca E-107 or E-113. Also want some air wheels.—Bennett Propeller Co., Morganton, N. C.

LIGHTPLANE WANTED. Have 1928 Harley 74 with new battery, new tires, new chain and sprockets. Motor just worked over, new bearings and crank-pin.—Robert B. Maguire, 2804 Peery Ave., Kansas City, Mo.

WACO, or similar plane wanted (licensed or licensable). Will trade 9 foot Mahogany racer (Class A) and 10 H.P. motor for it. Boat and Motor just overhauled and in A-1 condition.—A. C. Roethlisberger, 423 S. Darling St., Angola, Indiana.

LIGHTPLANE WANTED. 1 or 2-place, must be licensed and ready to fly. I have an 18 ft. motor boat with a 75 H.P. Gray Marine motor, Mahogany Hull. One 30 model 74 H.D. motorcycle in good shape. One practically new 21 jewel Hamilton railroad watch, one Conn Trumpet, good as new with case and mutes. What have you to swap in the way of airplanes?—I. D. Townsley, 1247 Latham St., Memphis, Tenn.

INTERNATIONAL F-18 5-place, with Wright motor (220 h.p.) will trade for 2 or 3-place ship in good condition, late model car or will sell cheap for cash.—Joe Rowlett, c/o Boone Motor Co., Whitesburg, Ky.

ALEXANDER EAGLE ROCK, 3-place biplane, PX5 Dual controls. Excellent trainer. Good condition. Always hangared. Licensed. Will trade for Great Lakes, Bird, Waco needing repairs or similar. What have you?—Joe Halenda and William H. Thomas, 329 South Balliet St., Frackville, Pa. (Schy. Co.)

HEATH B4 WANTED. Church Marathon J3 or Aeronca in first class condition, a pair of wheels and tires for a Heath, also wings for Palmer Marine Engine, four-cylinder, four-cycle ten-horsepower, reverse gear and clutch. Bosch mag. Hipano Suiza 325 horsepower, dual mags and plugs. Both motors are in excellent condition inside and out.—M. E. Walters, c/o Lees Farm, Danbury, Conn.

HEATH PARASOL with almost new Heath-Henderson engine. Needs prop, covering, and a few minor repairs. I want sporting equipment, two-place plane, or what have you.—Allen Henderson, 2602 W. 87th St., Seattle, Wash.

FOR SALE OR TRADE. B4 Motor, 15 hours; V Model Heath, almost complete. Can be finished in two weeks. Will consider good truck, tractor, aerial camera or what have you? Sell ship or motor separately. No reasonable offer refused. This is a bargain for someone.—J. Carl Haney, 1009 Quarrier St., Charleston, W. Va.

RACING CAR, underslung Ford, wire wheels, new vee type shell, trade for lightplane motor, or a glider.—Lennart Kyhlberger, 205 Taaffe Place, Brooklyn, N. Y.

LIGHTPLANE WANTED, in good condition. Have many things too numerous to mention, including a wonderful Model "T" motor.—John Breisch, Ringtown, Pa.

CLEVELAND PLANS WANTED. Will trade Monocoupe Model pictured in November M. A. N. Send list.—Glen Courtwright, Lincoln, Ill.

1931 OAKLAND V EIGHT SEDAN. Will trade for licensed Great Lakes plane in good condition or similar two or three-place ship. This car absolutely looks and runs like new, has four new tires and many extras.—Robert Heidel, 2563 No. 44th St., Milwaukee, Wis.

WANTED. One or two-place Cracked plane in any condition, must be a factory built job.

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Chicago, Ill.

What do you want?—W. H. Paille, 110 Lincoln Ave., Central Falls, R. I.

WANTED. A three place OX5 or OXX6 powered biplane. The plane must be in good flying condition and licensed. Will trade a sixty-five point diamond in an 18K white gold lady's mounting. The ring is perfect and cost $300.—R. M. Rossel, 127½ N. Main St., Upper Sandusky, Ohio.

AERONCA WANTED. 1 or 2-place licensed or eligible for license. Have new 16-foot cedar built speed boat, new 16 H.P. outboard motor and Willys-Knight sport roadster. If ship is worth it, will pay cash difference.—Wm. T. Lovelace, 1406 Grand Avenue, Jackson, Mississippi.

WANTED. Davis Monoplane, less motor, slightly damaged or Davis parts. Will trade 18 ft. Oldtown canoe, 20 gauge Rem. Pump Gun, both in perfect condition and cash if necessary.—John Henry Wright, 104 West Fourth St., N. Manchester, Indiana.

AIRPLANE WANTED for a 29 Model A Ford Tudor. Just overhauled. Tires good. Want something licensed or eligible. Might consider sportplane. Also OX5 crankshaft. Electric motor.—Harold Reed, Maroa, Ill.

YOUNG MAN, 21, will do work of any kind in exchange for a used unlicensed Airplane. A fair mechanic and trouble-shooter.—N. W. Ronan, Rocklake, N. Dak.

CURTISS JR. WANTED. Will swap an Elias Monoplane less motor, 2- place, side-by-side covertible coupe, oleo landing gear, chrome Molybdeuum steel tubing construction throughout. Ship weighs 650 lbs. less motor and is built for the hardest kind of stunting. Will pay cash difference if your ship is worth it.—John F. Rane, Center Road, Gardenville, N. Y.

WILL TRADE a Waco "9" OX5 in excellent flying condition, unlicensed new prop, air-speed, compass, for 2-place job Monoplane preferred, minor crack up, late model car, or what have you? OX5 Long Wing Eaglerock needing Magneto, repairs and recovering, want car, make me an offer.—H. A. Page, 106 N. 8th St., Richmond, Va.

AIRPLANE SUPPLIES

HEATH FUSELAGE WANTED. Will trade new Royal typewriter, used L. C. Smith typewriter, guns, high power field glasses, Model 51 Crosley radio, camera, books on aviation and cash.—W. G. Howard, P. O. Box 87, Greenville, S. C.

PROPELLER. Eight-foot wooden, wartime prop. to trade for airplane photos, negs., or what have you?—Ted Niff, 422 24th St. N., St. Petersburg, Fla.

WILL TRADE Heath tail parts for Fisher Body Kit and wood working tools, lathe preferred.—Hans Meier, Rt. 2, Box 334, Medford, Oregon.

WILL SWAP twelve successive issues of Popular Aviation for an untouched ¾" scale kit.—Martin Maciag, Jericho, Long Island, N. Y.

WHAT AM I OFFERED in trade for one upper right wing, complete tail assembly, two 30 x 5 wheels, tires and tubes, three ailerons and complete set of instruments for a Waco 90. Also have many other airplane parts. Will trade above parts and pay cash difference for a licensable D. H. Moth, less motor, Travelair, Waco, Aeronca, Taylor Cub, Fleet, Bird or what have you?—Harry Graham, Jr., Woodmont, Martins Ferry, Ohio.

RILES, small wheels with tires, tubes wanted. Will trade model airplanes, supplies, plans, also electric movie picture machine. Will also consider other aircraft parts.—Paul Rau, 514 Gorgos St., Pittsburgh, Pa.

WANTED. Parts damaged or undamaged, left lower panel for Waco 10, also licensable prop. for OX5. Must be cheap for cash or what do you want?—L. P. Kowalke, Wall Lake, Iowa.

SPORT BIPLANE wings complete. Perfect condition. Flytex covered. Berryloid doped. Exchange for 50 horsepower Gnome motor or what have you?—Box 51, Hillsboro, Ind.

MODEL AIRPLANE SUPPLIES, magazines, kits, and plans wanted. I have stamps, music, plans, chemical laboratory, magazines, books, etc.—Leroy Hart, Fairland, Okla.

FUSELAGE AND TAIL SURFACES for Corben Junior. All factory welded. Will trade a new Atwater-Kent Radio or used Chevrolet car.—A. L. Slipe, Greggton, Texas.

ONE BARLING NB 3 FUSELAGE, complete with tail-surfaces. Fuselage uncovered slightly cracked. Complete cowling and dual controls, ½ of landing gear, 1 MGH High Wing Monoplane complete less motor, unlicensed single-place fuselage, uncovered. One extra MGH Monoplane wiring covered complete. Dope, cable, etc. 2 uncovered 3' x 7' wings with fittings. Will swap for 28 or later motorcycle, shop equipt, small lathe, electric drills, acetylene torch, etc.—Chas. Jensen, Western Airmotive Service, 1427 52nd St., Sacramento, California.

ENGINES — ACCESSORIES

PRATT AND WHITNEY C, and C1 Wasp parts in perfect condition to trade for garage equipment. What have you?—E. J. Thames, 2761 W. 5th St., Ft. Worth, Texas.

MOTORCYCLE ENGINE, 1-cyl. What have you in trade?—Roland Hoover, Route 7, Princeton, Illinois.

WILL TRADE used typewriter for airplane propeller or gasoline motor.—Bob Merralls, 725 S. Longwood, Los Angeles, California.

LIGHTPLANE MOTOR WANTED. Have small 4-cyl. 12 H.P. water-cooled motor, 20" high, 17" long, 11¼" wide. Has clutch and radiator suitable for midget car or boat, A-1 shape. Will exchange even.—Hugh Mitchell, Jr., Route 1, Franklin, Pa.

MOTORCYCLE ENGINE WANTED. Must be in good condition. Have two propellers and other things to trade.—Anthony Wikswo, New Egypt, N. J.

2-CYL. HARLEY MOTOR. What have you?—Barney Klein, 1726 E. 55th St., Cleveland, Ohio.

PIETENPOL AIR CAMPER to trade for Salmson, Szekely, twin opposed, or any air-cooled motor around 35 H.P.—Harold Hen, 249 Manor Ave., Millersville, Pa.

ONE "SPAKE" MOTOR for trade. 2-Cyl. 16-20 H.P. with prop, air-cooled. Weight 65 lbs. Like small metal lathe or something I can use.—Francis McKinnon, 200 North Perry St., Hagerstown, Ind.

TRANSFORMER WANTED. Preferably I KW 25,000 volts for use on 110 volt 60 cycles. I have much to trade, including a 110 volt Gen. Electric D.C. Generator, capacity 500 watts.—Willis F. Dalhaus, Nokomis, Ill.

ANZANI BTE. WANTED. 8 cyl., 60-65 H.P., suction intake motor. Needn't be complete.

Particularly want crankcase halves and cylinder. —Nathan Frank, 4036 Fairfax Rd., Baltimore, Maryland.

MAYTAG ENGINE in good condition. What have you?—J. W. Goodwin, 2414 Third Ave., Richmond, Va.

MONOCOUPE, Velie powered, licensed, motor, just overhauled. Will trade for good light car with cash difference.—Kelso McFall, 625 Holly St., Perry, Okla.

WANTED—Small lightplane engine. Will trade telescope, 16 power; 2 pair boxing gloves; camera; chemistry set, boy scout signal set, German belt buckle, etc.—Victor Pagano, 21½ Genesee St., Albany, N. Y.

ANZANI, 60 H.P. with Skinner cap and prop. Good condition. Will trade for four small air wheels, small lathe, or what have you?—Richard B. Walrond, West Main Street, Bedford, Va.

MISCELLANEOUS

WANTED. Typewriter in good condition, Popular Mechanics October, 1930, Popular Science, February, 1932; Blueprint for Ed Borntraeger's front drive midget car, small press, small motors for model airplane. I have five tube radio battery sets, radio parts, Popular Mechanics Magazines and lots of others, pigeons, etc., might add some cash.—Leon H. Levesque, 11 Gilmore St., Foxboro, Mass.

MOTORCYCLE WANTED. Will trade a complete electric engineering course by L. L. Cooke and 8 volumes Engineer's and Mechanic's Guide. —Ellsworth L. Heaton, Sentinel Butte, N. Dak.

STAMPS, 25 different from 25 different countries, 3c. 60 to 70% discount approvals.—Box 764, Kalispell, Mont.

I HAVE the following: Punching bag with swivel, set of 4 boxing gloves, 130 foot of new manila rope, Farmer Burns Wrestling courses, set of historic airplane pictures, pair of 6 lb. Indian clubs. I want leather helmet and goggles, milo bar bell not less than 200 lbs. or what have you?—Edmund J. Moeckel, Pond Hill, Naugatuck, Conn.

STAMP COLLECTION of over 3,000 different stamps in International Junior Album. Also Philco Short Wave converter. Will trade for Radio and movie apparatus, motorcycle or what have you?—Jim Bair, 815 Pearl St., Logansport, Indiana.

Aero-Sportswomen

(*Continued from page* 20)

in the wash basins. There is a large lounge and dining room combined.

All of the passengers were given an opportunity to inspect the inside of the ship. The hydrogen is carried in a number of large bags inside the hull, on either side, and there are storerooms for the luggage and provisions and the crew is also quartered there.

"There is very little noise and practically no sense of motion," Miss Ruegg said, "the engines were so mounted that they seemed to absorb the shock and vibration. And, as for the wind, even the night that we arrived in Akron and could not land because of the storm, there was no unpleasant rolling around."

* * *

THE Century of Progress has been the objective of several historic flights this past summer. And it has been the privilege of the editor of this column, to spend glorious hours at these events—such as the all-night vigil at the ill-fated stratospheric flight—to have an opportunity to interview some of the pilots of the Italian Armada, to "do" the fair with Ruth Nichols and to hold a heated argument with Phoebe Omlie on the difference between an amateur and sportsman pilot!

END.

Helicopters

(*Continued from page* 9)

helicopter which is yet to come. Not only did Breguet thus conceive the basic idea of the practicable helicopter, but he built and flew a pilotless helicopter at a time when the airplane was in its swaddling clothes. And still he is working on the helicopter.

For the sum total of his persistent efforts and the great result he has not, in so far as I am aware, received one *centime*. Nor has there been published by any student of the helicopter problem—except by the writer, in a previous article in POPULAR AVIATION—any passage which gives proper credit to him for his significant work. The bare statement that a helicopter of four screws built by him rose on August 24, 1907, was all that I could find.

Thus does the world repay its pioneers. Louis Breguet, making full use of the most valuable possession of man —a god-like, creative mind—takes up unharnessed elements of nature, harmonizes them, and presto! a new entity exists under the sun. Years later other skilled men develop the basic idea and the skies gradually become more and more filled with craft based upon it.

Men look up and see them fly overhead—giant eagles made of wood and steel—and they don't even so much as know that a man named Louis Breguet ever existed. Then perhaps, at last, some near-sighted research man *discovers* his work—and perhaps the world erects a statue to him, long after his last creative pain is done and he is dust. Such is the fate of almost all pioneer creators. And yet they labor on, remaking a kinder and more harmonized world for the more scientific human beings that they hope will live in the future.

END.

Airport

(*Continued from page* 26)

wahitchka, Florida. It is very easy to identify the place for the Fishing Lodge resembles a dude ranch, there being one main building and several small cabins in the group. In addition to a wind sock, there is a windmill on the property which also helps to identify the place. Later, it is probable that the name will be painted on the roof of the main building.

The field should require very little maintenance as Bermuda grass has been planted, which as everyone knows, spreads rapidly and makes a thick carpet, choking out other growths.

Similar projects are under way at Apalachicola, in Franklin County and also in Panama City, Bay County, Florida. These, however, are being constructed with the aid of Reconstruction Finance Corporation funds.

Using Idlewood Landing Field, Wewahitchka, Florida, as an example of how inexpensively an emergency landing field can be built, it is hoped other communities in the United States will sponsor the construction of landing fields with the aid of Reconstruction Finance Corporation funds in such counties where other funds are not available.

END.

U. S. AIR CORPS

Takes in this year 600 unmarried men between the ages of 20 and 28 and gives them free FLYING TRAINING consisting of 200 SOLO HOURS, including cross country and night flying. Gives them Special Uniforms, Traveling Expenses, and pays each man $75 a month. The course takes one year. The Training costs Absolutely Nothing. Let us tell You How to get In: Information about System, Leave, and Actual Life at the New $10,000,000 Field. Send your Name. Hand postman $1 and postage when information arrives. It is COMPLETE. Nothing else to buy.

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STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912.

OF POPULAR AVIATION, PUBLISHED MONTHLY AT CHICAGO, ILL., FOR OCTOBER, 1933.

State of Illinois } ss.
County of Cook }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared B. Geo. Davis, who, having been duly sworn according to law, deposes and says that he is the Editor of the Popular Aviation and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Aeronautical Publications, Inc., 608 So. Dearborn St.; Editor, B. Geo. Davis, 608 So. Dearborn St.; Managing Editor, J. B. Rathbun, 608 So. Dearborn St.; Business Manager, B. G. Davis, 608 So. Dearborn St.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given). Aeronautical Publications, Inc., 608 So. Dearborn St.; W. B. Ziff Co., 608 So. Dearborn St.; W. B. Ziff, 608 So. Dearnborn St.; David Ziff, 608 So. Dearborn St.; B. Geo. Davis, 608 So. Dearborn St.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the two paragraphs contain statements embracing affiant's full knewledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

Sworn to and subscribed before me this 27th day of September, 1933.

B. G. DAVIS
(Signature of editor, publisher, business manager or owner)

A. T. PULLEN
(My commission expires January 25, 1936.)

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PRACTICAL FLYING

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A BOOK FOR DAILY USE

AIRPLANE MECHANICS RIGGING HANDBOOK

by R. S. Hartz, formerly Lieut. Colonel, Air Corps, U. S. Army; and Lieut. E. E. Hall, formerly Editor, "Aircraft Servicing." 105 illustrations. $3.50

It is even more important for an airplane to be perfectly rigged than for its engine to work perfectly. Dead-stick landings are commonplace, but no plane can land safely with a collapsed interplane strut or minus one wing. Every licensed airplane mechanic and every mechanic's helper will have daily, on-the-job use for this collection of tested and approved directions. As a manual of operating procedure, it is needed by every pilot and airport service man.

This book tells you how to get an airplane into safe flying condition and how to keep it that way. It is written in plain language, without mathematics, that anyone can easily understand. The instructions are given in great detail, explaining how each operation should be done, in what order, and the reasons why. Just as useful are the many don'ts warning the rigger not to do the wrong thing. The book deals fully with handling planes on the ground and in the shop; how to true up the assembled ship; how to adjust the wings and control surfaces for "hands off" flying; the materials for patching, splicing, and repairing of all kinds; practical hints for riggers; installing and correcting compasses; methods of plane inspection.

A COMPLETE ENGINE COURSE

AIRCRAFT ENGINE MECHANICS MANUAL

by C. J. Moors, Chief Instructor, Dept. of Mechanics, Air Corps Technical School, U. S. Army. 189 illustrations. $4.50.

This book covers the same ground as the course given the enlisted mechanics of the Army Air Corps with the addition of much data on types of equipment adapted only for commercial airplanes. It deals thoroughly with all kinds of aircraft engines and their accessories. It explains exactly how they operate and the features in which the various makes of competing equipment resemble each other and those in which they differ.

Mr. Moors gives all needed data on construction and operation, supplies full instructions for proper maintenance, and shows you exactly how to go about making any necessary repairs and adjustments. Photographs, diagrams, and working drawings make it easy for you to follow each explanation.

Among the engines dealt with are: Pratt & Whitney Wasp, Wasp Junior, Hornet; Wright Whirlwind, Cyclone; Curtiss D-12, Conqueror, Challenger; Lycoming; Packard-Diesel; Warner-Scarab; Kinner; LeBlond; Continental; Liberty. Equipment covered includes: Scintilla Magnetos, Types AG and V-AG, Double Magneto Type SC, N Series; Eclipse and Leece-Neville Electric Generating Systems; Delco Battery-Generator Ignition System; Eclipse Engine Starters; Zenith and Stromberg Carbureters; Superchargers; Cooling and Lubricating Systems, etc., etc.

EVERY AIRMAN NEEDS THIS

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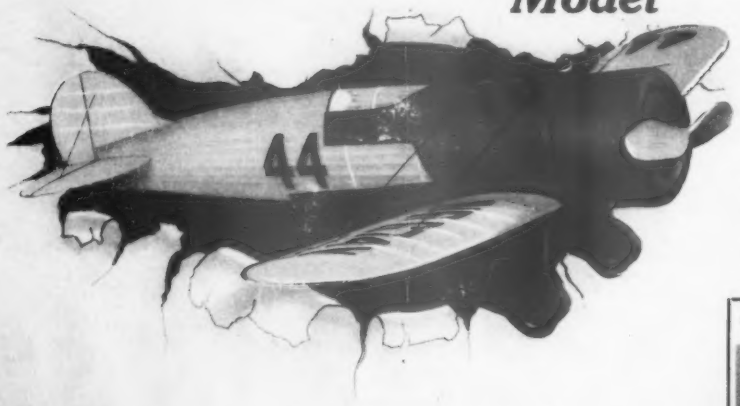

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